ARCHIVES OF

Physical Medicine and Rehabilitation

OCTOBER 1961
Volume 42, No. 10

Archives of Physical Medicine and Rehabilitation

Code of Advertising

The *Archives of Physical Medicine and Rehabilitation*, published monthly by the American Congress of Physical Medicine and Rehabilitation, is interested in the maintenance of the highest standards in advertising in the interest of its readers in the medical and closely allied professions, the various manufacturers and patients. The *Archives of Physical Medicine and Rehabilitation* believes that honest, straightforward and informative promotion is essential in the merchandising of products and apparatus affecting the health and welfare of the general public. For this reason, the APM&R has formulated some basic principles to serve as a guide to manufacturers and advertisers.

CLAIMS

1. Claims for the efficacy or usefulness of a product should be logically and appropriately based upon scientific evidence or authoritative opinion expressed by qualified persons.

2. Claims should not be stronger than the evidence warrants and should be expressed in such a way as to avoid multiple interpretation. Implied endorsements by ambiguous statements are not acceptable. *The journal reserves the right to modify or exclude copy that is extravagant in claims without consulting advertiser and/or agent if time before publication deadline is a governing factor.*

3. Statements of endorsement or use of a product or apparatus by physicians or by institutions or by individuals in allied professions are not acceptable.

4. The statement of claims should be made in language appropriate to the understanding of the intended reading audience. If such statements are not clearly made, they may be misleading or confusing thereby doing disservice to both publisher and advertiser.

5. Length of time a product has been on the market and relative sales position are not necessarily evidence of its merit and hence such information cannot be considered appropriate argument for prescription or recommendation.

6. Promotion suggesting undesirable consequences from failure to use any product or apparatus unless compelling evidence exists is unjustifiable.

EVIDENCE

1. Evidence presented in promotion of products or apparatus should serve the function of validating any or all claims made. While interpretation of findings may vary among physicians, claims must adhere to the evidence and not to questionable extrapolations.

2. The significance of evidence should not be magnified to the point of overemphasis and quotations and/or excerpts should not disregard the context or the full meaning of the source.

3. Evidence should be readily and reasonably available. Manuscripts may be cited as references only after publication. Personal communication is acceptable only when the author has had an opportunity to review the intended promotion and has granted written approval for the citation. A copy of any personal communication to be included in advertising copy and a copy of permission directed to the manufacturer to use such personal communication must be on file in the office of the publisher prior to such information being released for publication in the journal. Descriptions of findings demonstrated in scientific exhibits not subsequently published in a generally available periodical do not constitute suitable evidence.

4. Evidence derived from adequately controlled research should be differentiated from uncontrolled clinical experience. Where the advertiser sets forth his own conclusion or rationale, it should be done without implication of other authority.

COMPARISONS

1. Promotion of a product or apparatus should relate the merits of the product or apparatus to generally acceptable medical standards.

2. Direct comparison with other products or apparatus for the purpose of demonstrating superiority is permissible only when such claim can be supported by direct reference to a published report.

3. Implied superiority of a product or apparatus through the overuse of superlatives is not acceptable.

POSITION OF THE MEDICAL PROFESSION

1. Promotion that tends to undermine the patient's trust and confidence in his physician is prejudicial to the effective practice of medicine and must be avoided.

2. Promotion that results in the patient bringing pressure on the physician to prescribe according to suggestion or the current vogue rather than by exercise of professional judgment, is unacceptable.

3. Promotion that encourages the patient to assume the prerogatives of the physician is unwise. It should be avoided as detrimental to public health. A prescription of drugs and/or therapeutic appliances leading to the time and sequence of the introduction of other treatment should remain the responsibility of the physician. Promotion influencing the patient to assume these responsibilities or creating concern regarding the physician's recommendations is not acceptable.

The APM&R Code of Advertising conforms to the principle that promotion directly to the public of products and apparatus which require a physician's special knowledge for the proper administration is not in keeping with the best health and welfare of the general public. The APM&R Code of Advertising is subject to alteration and clarification as indicated by the experience and wisdom that will be acquired through cooperative efforts of medical, industrial, educational and public organizations.

ARCHIVES OF
Physical Medicine and Rehabilitation
OFFICIAL JOURNAL AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION
AMERICAN ACADEMY OF PHYSICAL MEDICINE AND REHABILITATION
30 N. Michigan Avenue, Chicago 2, Illinois

Original contributions, exchanges and books for review should be forwarded to the Editorial Office. All business matters including advertising should be handled through the Executive Office, 30 N. Michigan Ave., Chicago 2, Illinois. Statements in the manuscripts published in the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION are made solely on the responsibility of the author. The American Congress of Physical Medicine and Rehabilitation and/or the American Academy of Physical Medicine and Rehabilitation does not assume any responsibility for statements contained therein. Manuscripts accepted for publication in the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION are for exclusive publication and may not be published elsewhere.

♦

Subscription—In the United States, its possessions, and Mexico, $8.50 yearly; Canada, $9.50; elsewhere, $14.00 the year; $1.00 per single copy; special issues $1.50 per single copy. Advertising rates on application. All advertising copy subject to acceptance by Publication Committee. Permission will be granted on request for reproduction in reputable publications if proper credit is given. Reproduction for commercial purposes will not be permitted. Published monthly at Chicago, Illinois, by the American Congress of Physical Medicine and Rehabilitation. Entered as Second Class Matter at the Post Office at Chicago, Illinois. Copyright 1961, by the American Congress of Physical Medicine and Rehabilitation.

♦

American Congress of Physical Medicine and Rehabilitation

OFFICERS

DONALD J. ERICKSON,
Rochester, Minn., President
JEROME S. TOBIS
New York, President-Elect
CHARLES D. SHIELDS
Washington, D.C., First Vice-President
WILLIAM J. ERDMAN
Philadelphia, Second Vice-President
LEWIS A. LEAVITT
Houston, Third Vice-President
EDWARD W. LOWMAN
New York, Fourth Vice-President
FRANK J. SCHAFFER
Washington, D.C., Fifth Vice-President
JOSEPH G. BENTON
New York, Secretary
FRANK H. KRUSEN
Minneapolis, Treasurer
GLENN GULLICKSON, JR.
Minneapolis, Executive Director
DOROTHEA C. AUGUSTIN
Chicago, Executive Secretary

EXECUTIVE COUNCIL

Donald A. Covalt, New York, *Chairman*
Frederic J. Kottke, Minneapolis, *Secretary*
Robert L. Bennett, Warm Springs, Ga.
William Bierman, San Francisco.
Earl C. Elkins, Rochester, Minn.
Kristian G. Hansson, New York.
Abraham R. Hollender, Miami Beach, Fla.
O. Leonard Huddleston, Santa Monica, Calif.
Arthur C. Jones, Portland, Ore.
H. Worley Kendell, Peoria, Ill.
Miland E. Knapp, Minneapolis.
A.B.C. Knudson, Washington, D. C.
Frank H. Krusen, Rochester, Minn.
Gordon M. Martin, Rochester, Minn.
Walter S. McClellan, Chapel Hill, N. C.
Fred B. Moor, Los Angeles.
William D. Paul, Iowa City.
Nathan H. Polmer, New Orleans.
Donald L. Rose, Kansas City, Kans.
William H. Schmidt, Philadelphia.
Wm. Benham Snow, New York.
Norman E. Titus, Verona, N. J.
Arthur L. Watkins, Boston.
Donald J. Erickson, Rochester, Minn.,
Ex-officio

♦

PRINTED IN U.S.A.

EDITORIAL BOARD

PAUL A. NELSON, Cleveland, *Chairman*
FREDERIC J. KOTTKE, Minneapolis
JUSTUS F. LEHMANN, Seattle
OSCAR O. SELKE, JR., Houston
G. KEITH STILLWELL, Rochester, Minn.
JEROME S. TOBIS, New York
ARTHUR L. WATKINS, Boston

♦

The ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION is devoted to the publication of significant articles in this particular field. Contributions of interest to those in physical medicine and rehabilitation are invited. Articles are accepted only with the understanding that they are contributed exclusively to the ARCHIVES. Articles and accompanying illustrations become the property of the journal.

MANUSCRIPTS

Submit only the original copy of the article, but retain a copy for use in correcting galley proofs. Carbon copies are not acceptable for editing and typesetting purposes.

REFERENCES

References should be placed at the end of the manuscript and should conform to the style of the Quarterly Cumulative Index Medicus. No more than twenty references should be included with a manuscript.

ILLUSTRATIONS

Only reproducible illustrations will be accepted. All photographs must be black and white glossy prints, clear cut and contrasting. The size of each photograph submitted should be no larger than 2⅜" x 2". Instructions for combining photographs are acceptable. The Editorial Board reserves the right to limit the number and size of illustrations used with any manuscript submitted for publication. Any number of illustrations over three (3) is charged to the author.

REPRINTS

Reprint order blanks with a schedule of prices will be attached to galley proofs. Individual reprints of an article must be obtained direct from the author.

COPYRIGHT

Matter appearing in the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION is covered by copyright. Permission for reproduction must be directed to the Editorial Board.

Detailed information covering instructions for the preparation of manuscripts for publication may be had by writing direct to the Editorial Office, 30 N. Michigan Ave., Chicago 2.

CLINICALLY PROVED TREATMENT FOR POSTMASTECTOMY LYMPHEDEMA

JOBST Intermittent Compression Units are being successfully used to reduce lymphedema by gentle, pneumatic massage. This is followed by fitting the limb with a custom-made Jobst Venous Pressure Gradient Support. Only Jobst Supports have built-in, correct, gradient counter pressure to offset the increased interstitial pressure attendant to lymphedema.

Britton, Richard C.: Management of Peripheral Edema, Including Lymphedema of the Arm After Radical Mastectomy, Cleveland Clinic Quarterly, Vol. 26: No. 2, pp. 53-61, April, 1959.

Brush, Brock E.; Wylie, John H.; and Beninson, Joseph: Some Devices for the Management of Lymphedema of the Extremities, The Surgical Clinics of North America, Vol. 39: No. 6, pp. 1493-1498, December, 1959.

Beninson, Joseph: Six Years Of Pressure-Gradient Therapy, Angiology, Vol. 12: pp. 38-45, January, 1961.

Clinical Model shown. Smaller, low-priced Home Model now available.

For complete information and prescription blanks, write to

THE JOBST INSTITUTE, INC.

1805 Jefferson Avenue • Toledo 2, Ohio

IMPORTANT

Effective January, 1962, the following subscription rates to the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION apply

UNITED STATES, ITS POSSESSIONS; PUERTO RICO, AND MEXICO	**$10.50 yearly**
CANADA	**$11.50 yearly**
ELSEWHERE	**$15.00 yearly**
SINGLE ISSUES (current)	**$ 1.00 per copy**
SPECIAL ISSUES (current)	**$ 1.50 per copy**

These revised rates apply to all subscriptions, new and/or renewal. The date of subscription receipt by the ARCHIVES determines rate to apply. UNESCO coupons are not acceptable in payment of any subscription. Foreign subscriptions will be accepted with the understanding that issues claimed not received will be replaced at current issue cost. If a mailing address as furnished appears correctly on our mailing list, a missing issue will be replaced without charge. The ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION reserves the right to limit such replacement distribution.

All subscriptions to the ARCHIVES are non-cancellable. This clause covers all subscriptions currently in effect, as well as all subscriptions received—new or renewal. To insure delivery of your copies of the ARCHIVES, the Editorial Office must be notified six (6) weeks prior to change of address. For your convenience, may we suggest the use of POD Form 3573 for address changes. These forms may be obtained from your local post office without charge. The U. S. Post Office does not provide directory and/or redelivery service. Journals destroyed by the U. S. Post Office can be replaced only if the issue is still available and upon prepayment of current issue cost. All prices subject to change without notice.

massages pain away in musculoskeletal involvements[1]

GER-O-FOAM

(aerosol foam)

relieves pain, spasm; improves function increases tolerance to exercise

GER-O-FOAM's exclusive formula provides for the first time deeply absorbed analgesic-anesthetic agents in aerosol form — to permeate and anesthetize sensory nerve endings.

Relief in minutes, lasting for hours in . . . rheumatoid arthritis, osteoarthritis, muscle sprain, fibromyositis, low back pain . . . even in chronic intractable cases.

GER-O-FOAM combines: Methyl salicylate 30%, benzocaine 3%, in a neutralized emulsion base, permitting fast penetration through the stratum corneum.

Sample and reprint from

GERIATRIC PHARMACEUTICAL CORP.

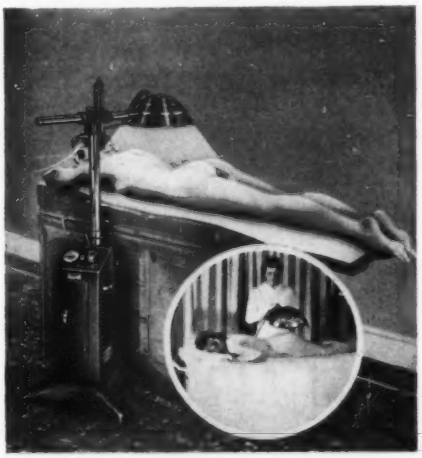
Bellerose, New York

Pioneers in Geriatric Research

1. Gordon, E. E. and Haas, A.: Industrial Medicine & Surgery 28:217, 1959.

*A **MUST** IN DERMATOLOGY*

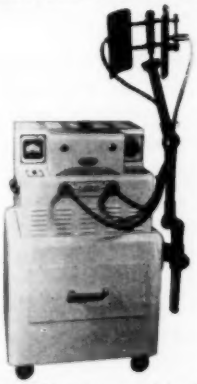
FISCHERQUARTZ



Model No. 88

R. A. FISCHER & CO.

A *MUST* IN DIATHERMY
THE MASTER FISCHERTHERM



Model No. 1200 — A powerful, dependable machine for continuous performance, night & day.

FISCHER DRY PADS FOR LOW VOLT
NO MOISTURE
SEND FOR DETAILS

517-525 COMMERCIAL STREET
GLENDALE 3, CALIFORNIA

Eastern Office and Warehouse: HABER INC., 2043 CHESTNUT ST., PHILADELPHIA 3, PA.

FISCHERTHERM • FISCHERSINE • FISCHERQUARTZ • FISCHER ULTRA SOUND

HYDROCOLLATOR

Steam PACK®

MOIST HEAT

U. S. Pat. No. 2,710,008

Now moist heat can be applied conveniently, effectively and with a minimum investment in equipment. No dripping, no wringing, no repeated applications. Each application gives at least 30 minutes effective moist heat. The Steam Pack is merely heated in water, wrapped in a towel, and applied. Standard equipment in leading hospitals and clinics across the nation.

Folder and prices on request

Originated and Manufactured by

CHATTANOOGA PHARMACAL CO., INC.

CHATTANOOGA 5, TENNESSEE

D-3 Table Model

E-1 Table Model

SS Table Model

SS-2 Console Model

M-2 Console Model

MASTER UNITS: Five stainless steel models for various requirements in hospitals, clinics, physicians' offices, and patients' homes. Automatically maintain Steam Packs in water at proper temperature—always ready for use. No plumbing used.

READER SERVICE . . .

this section is established for the convenience of the reader-audience of the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION. Each month, the reader service column will list the complete name and address of the author to be contacted for information and/or reprints of scientific studies herein published. The column will be up to date at press time, but the ARCHIVES cannot guarantee the accuracy of such listings 30 days after publication date. The following authors, in Contents order, are represented in the October, 1961 issue:

ALLEN S. RUSSEK, M.D., 400 East 34th Street, New York 16, New York.

ALBERT L. COOPER, M.D., 742 Medical-Dental Building, Seattle, Washington.

DR. JACQUES LE FEBVRE, 76 Rue Notre-Dame des Champs, Paris VI, France.

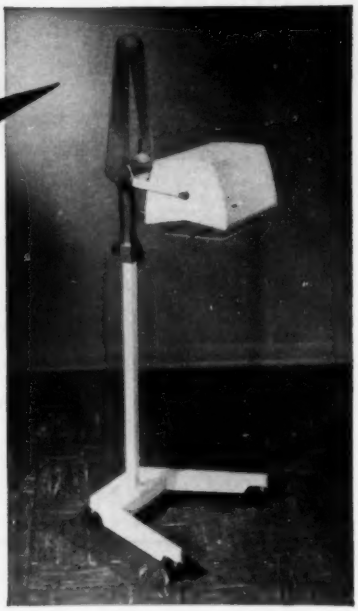
ISRAEL MUSS, M.D., Veterans Administration Hospital, Louisville, Kentucky.

DR. BRYNJULF STRANDBERG, Department of Physical Medicine, Rheumatism and Rehabilitation, Copenhagen County Hospital, Hellerup, Denmark.

ROBERT A. WALKER, 1900 Chicago Avenue, Minneapolis 4, Minnesota.

Please do not direct requests for reprints to the Archives of Physical Medicine and Rehabilitation

Announcing Burdick's New Infrared Lamp

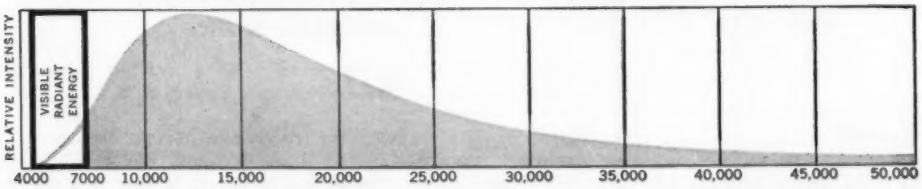


New ZOALITE 500 LAMP features long-range, retractable extension arm.

The new Burdick Z-500 Lamp greatly enhances the effectiveness of infrared therapy. Its special long-life quartz tube has ideal spectral characteristics. (See chart below.) Deep penetration is assured for any part of the body.

New equipoise arm permits positioning over widest treatment table. Unique counterbalanced construction holds lamp stationary. The Z-500 also has an Alzak aluminum reflector designed to project radiation evenly over the treatment area. Hot spots are eliminated.

the heart of the new Z-500 is its quartz infrared tube



RELATIVE SPECTRAL DISTRIBUTION IN ANGSTROM UNITS — BURDICK Z-500 LAMP

As will be noted from the above chart, most of its radiant energy is in the range which is capable of the greatest tissue penetration.

SEE THE NEW BURDICK Z-500 ON DISPLAY AT YOUR DEALER'S . . .

Burdick®

THE BURDICK CORPORATION
MILTON, WISCONSIN
Branch Offices: New York • Chicago • Atlanta • Los Angeles
Dealers in all principal cities

PRESTON®

A Complete Line

FOR PHYSICAL MEDICINE AND REHABILITATION

Your one source for all your needs

THE PRESTON CATALOG NO. 1065

The Most Complete Catalog in the Field

The Preston Catalog is designed for your convenience in ordering all your requirements from one dependable source. The new edition, including over 2,500 items, is the most complete Ordering Guide for your Physical Therapy and Rehabilitation Equipment.

To insure complete quality control, prevent substitution, and give you the benefit of lowest prices, Preston maintains a policy of selling only directly to institutions and the profession. We do not sell through dealers. All orders sent to Preston Headquarters receive personalized, prompt service — usually same-day shipment.

Requests for Catalog should be sent on your letterhead to J. A. Preston Corp., Dept. A.

PC 3819B CLINICAL MODEL

JOBST INTERMITTENT COMPRESSION UNITS

For Effective Management of Lymphedema and Peripheral Vascular Conditions

Incapacitating, intractable edema of the extremities has long presented a difficult problem. Now, a constantly growing volume of clinical literature has shown dramatically effective results in cases of lymphedema and peripheral vascular conditions.

Order By Catalog Number:

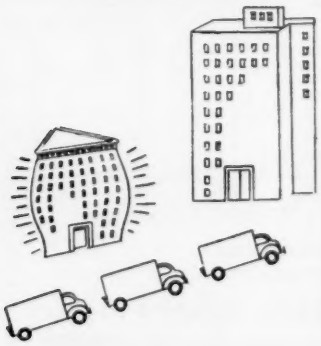
PC 3819A Jobst Intermittent Compression Unit — Hospital Model — will treat up to four extremities simultaneously $695.00

PC 3819B SAME — Clinical Model — Portable — treats one extremity $389.00

PC 3819C SAME — Home Model — Portable $249.00

Jobst Pneumatic Appliances must be ordered together with the compression units. The most widely used ones are:

PC 3820A Arm Sleeve $45.00 **PC 3820L Leg Sleeve $49.50**



IMPORTANT NOTICE

J. A. Preston Corp. has moved to a vastly larger new headquarters at **71 Fifth Avenue, New York 3, N. Y.**

Thanks to the ever-growing patronage of our thousands of customers, we have outgrown our original quarters. So, in order to maintain our consistent record of prompt and efficient service, all offices and warehouse operations have been consolidated in the much larger space at the new address. In planning the move, advantage has been taken of the most modern and scientific concepts in warehouse layout in order to raise to a new high the promptness of our service.

Send all orders to →

J. A. PRESTON CORP.

71 Fifth Avenue, New York 3, New York

10-SECOND SET-UP for all-position THERAPY with safe, effective L-F SHORT-WAVE DIATHERMY

Here's versatility to simplify every diathermic treatment procedure—yours so conveniently in the treatment-proved L-F Short-Wave Diathermy.

Speed? In most applications the set-up time is only 9 or 10 seconds. Flexibility? Practically unlimited! L-F air-spaced plates, L-F hinged treatment drum and the utility applicator, give you everything you need. Effectiveness? Proved by its successful use in hospitals, clinics, and medical offices all over the country.

Let the proved L-F Short-Wave Diathermy streamline *your* treatment programs.

Ritter
COMPANY INC.
ROCHESTER 3, NEW YORK
Medical Division

RITTER COMPANY INC.
6010 Ritter Park
Rochester 3, N.Y.

Please send literature on L-F Short-Wave Diathermy.

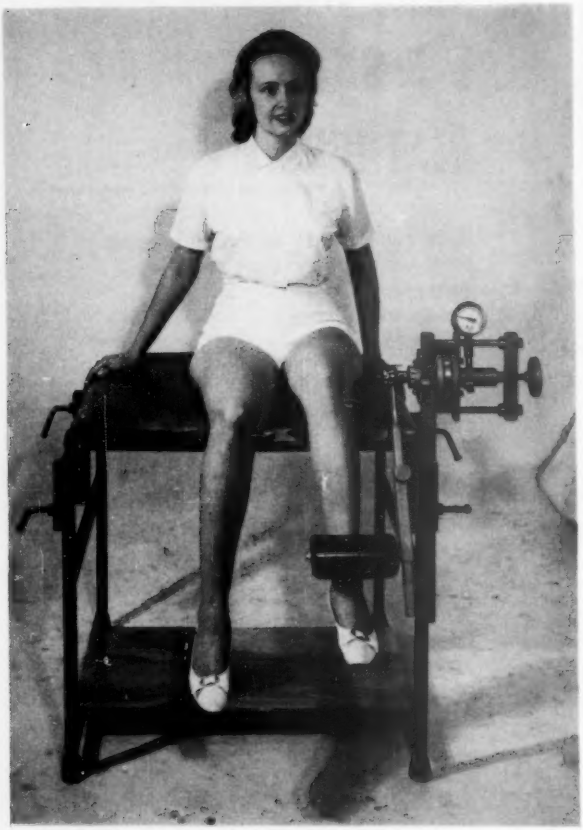
NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Introducing

LaBERNE'S New Hydraulic Exercise Unit



Using Pressure Clutch, with
Resistance maintained through
Hydraulic cylinder, pressure setting by
Hydraulic gauge from 0 to 70 lbs.

UNIT EASILY CHANGED FROM LEFT TO RIGHT—ADAPTABLE FOR USE AS
A SHOULDER ROTATOR OR SHOULDER WHEEL

LaBERNE MANUFACTURING COMPANY
P. O. BOX 5245 – COLUMBIA, SOUTH CAROLINA

Fred
LANDAUER
COMPANY

SPECIALIZING IN
EQUIPMENT FOR
ELECTRO-THERAPY
ELECTRO-DIAGNOSIS

TECA ELCO
11 BLENHEIM COURT
ROCKVILLE CENTRE, N.Y.
TEL: RO. 6-4527

california calling
GRADUATES OF APPROVED
SCHOOLS OF PHYSICAL THERAPY

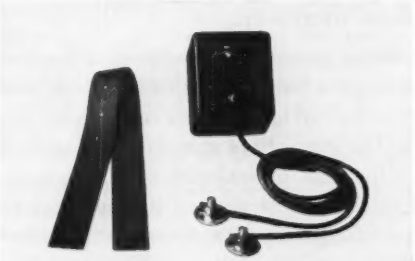
Openings in State Hospitals • Veterans' Home
Crippled Children Services Program

Starting salaries $458 and up; liberal employee benefits; promotional opportunities. Streamlined civil service examinations twice a month in San Francisco and Los Angeles and on request in other states near candidate's residence.

Apply: STATE PERSONNEL BOARD, Dept. PT 70
801 Capitol Avenue
Sacramento 14, California

Registered Physical Therapists, and **Occupational Therapists** for Rehabilitation Centers for Children and Adults. Supervisory and staff positions. **Speech Therapist,** member ASHA, staff position. All to work under direction of Boarded Physiatrist. Write Medical Director, Crotched Mountain Rehabilitation Center, Greenfield, New Hampshire.

WATERS MS-12
MUSCLE STIMULATOR



- DESIGNED FOR HOME USE
- LOW IN COST
- SIMPLE TO OPERATE
- RELIABLE GALVANIC OPERATION

WATERS CORP.

P. O. Box 288 • Rochester, Minnesota

Staff Physical Therapist position in 727 bed General Medical and Surgical Veterans Administration Hospital affiliated with Indiana University Medical School. Starting salary $5355 per annum. Yearly increases, liberal fringe benefits, hospitalization and life insurance plans available. Write Personnel Officer, VA Hospital, 1481 W. 10th St., Indianapolis, Indiana.

THREE STAFF PHYSICAL THERAPISTS for progressive program in 450-bed modern general hospital located in large leading Federal mental hospital which is nationally recognized teaching center. Applicants must meet standards established by AMA at time of graduation or APTA if graduated prior to 1936. One year professional experience required for starting salary of $5355. Positions in Career Civil Service. Liberal vacation and sick leave, life and health insurance and retirement benefits. Hospital situated on beautiful reservation near U. S. Capitol. Opportunity for advanced education at nearby universities. Write Personnel Office, Saint Elizabeths Hospital, Washington 20, D. C.

Georgia Warm Springs Foundation

GRADUATE COURSE

Physical Therapy and Occupational Therapy
In the Care of Neuro-Muscular Disease

This course is open to graduates of approved schools of physical and occupational therapy. Such graduates must be members of the American Physical Therapy Association and/or registrants of the American Registry of Physical Therapists, or members of the American Occupational Therapy Association.

Entrance Dates: First Monday in January, April and October.

Course I — Emphasis on care of convalescent neuro-muscular disease with intensive training in functional anatomy, muscle testing, muscle reeducation and use of supportive and assistive apparatus. This course is complete in itself.

Course II — Three months duration with Course I prerequisite. Emphasis on care of severe chronic physical handicaps with intensive training in resumption of functional activity and use of adaptive apparatus.

In-Service Training Program — Fifteen months duration at salary of $225 per month plus full maintenance, increasing to $250 per month at the completion of nine months. This program includes training in Courses I and II.

Tuition: None. Maintenance is $100 per month (except those on In-Service Training Program).

For further information contact:

ROBERT L. BENNETT, M.D.
Executive Director
Georgia Warm Springs Foundation
WARM SPRINGS, GEORGIA

CHIEF PHYSICAL THERAPIST

$5305 to $6770 per year

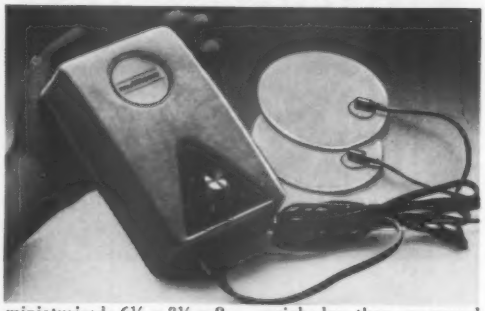
Head active, expanding program in 500 bed hospital. Physiatrist available for consultation.

Write: Mr. R. Elliott Scearce
Department of Personnel
City of St. Louis
235 Municipal Courts Building
St. Louis 3, Mo.

Patronize (Y)our Advertisers

new
multitone™
muscle stimulator for home therapy

ECONOMICAL, COMPLETELY TRANSISTORIZED BATTERY-POWERED FARADIC GENERATOR TO STIMULATE INNERVATED VOLUNTARY MUSCLES



miniaturized: 6½ x 3½ x 2 weighs less than one pound

SAFE
NO SHOCK HAZARD
SIMPLE TO OPERATE

Multitone — an aid in rehabilitation to help retard muscle atrophy in patients who cannot exercise voluntarily.

Multitone generates a double peak wave current — *not* a Sine wave, but a modified Faradic current known to produce a comfortable sensation. The intensity of stimulation is controlled by adjustable potentiometers. The output of the machine is interrupted 40 times each minute, causing intermittent exercise of selected muscles.

A trial demonstration is available at your convenience from our professional service representative.

multitone™
BILTON LABORATORIES, INC.
200 West 34th Street, Room 403, New York 1, N. Y.

I WAS A FOUR LETTER MAN AT COLLEGE!

(D-U-M-B)

Pigskins are flying across the country . . . the season of strains, sprains and muscle pains. I wish I could be a football star again (I wish I could once before, too!) But, I want to talk about something besides myself for a while.

During the past summer I talked with a number of physiatrists about a rather peculiar phenomenon that has been occurring in a few physical therapy installations around the country over the years.

This phenomenon is simply that there are a few locations where, after having been sold on the therapeutic technics of ultrasonics, have given up or discarded diathermy altogether.

I can't help but feel that this is a serious mistake . . . and one that we in the profession should take steps to counter-act. To begin with, there are some conditions where short wave diathermy is very effective while ultrasonics is not. Pleurisy is one that comes to mind right away. The wonderful relief afforded by the deep heat of an induction drum cannot be matched by any other physical therapy measure . . . and certainly not by ultrasonics, which has no effect on pleurisy.

Bronchitis is another condition where diathermy is superior. Many types of muscle strains, sprains and dislocations respond much better to short wave diathermy than to ultrasonics. So do many genito-urinary conditions. But the real issue is not which one is better nor which one is the method of choice, except in a very few specific treatments. For, never before in Physical Therapy, have two modalities so well conplemented each other as short wave diathermy and ultrasonics. (And, even though I'd rather take a whipping than say it, whether they're made by us or our competitors!)

Physicians who have pushed aside their trusted old short wave diathermy for the sake of newer ultrasonic apparatus are simply overlooking a formidable combination. Some ask us which therapy to use first. There is no absolute clinical advice to fit all circumstances, but we favor getting the circulation started and relaxing the spasm by means of diathermy . . . then applying ultrasonics locally and neurotropically (when feasible).

Always low levels . . . always respecting patient tolerances and comfort with both therapies. Some physiatrists add a half-hour under infra-red following both applications.

The combination treatment is not only effective in a great many rebellious or tough conditions, but is also impressive to the patient, is likely to improve his morale, and he is to establish a favorable psychological response because of the extent of personal attention received.

Cordially,

Cecil Birtcher

Cecil Birtcher, President
The Birtcher Corporation

THE BIRTCHER CORPORATION
4371 Valley Boulevard, Los Angeles 32, California
AP-1061

One Quarter Century
Of Honest Value
Sincerely
Presented

NO. 43 IN A SERIES

MISS PHOEBE

"What's the matter, young man—haven't you ever seen an Everest & Jennings *folding* wheel chair?"

Semi-reclining back model with elevating legrests is also available with *detachable* arms, *swinging, detachable* legrests

Fingertip-folding Everest & Jennings chairs have always been scene-stealers. But now attention has shifted to the things that people *do* in them. That's because Everest & Jennings chairs have a built-in "get-up-and-go" that helps new users overcome wheelchair shyness quickly. Exclusive features for balance, maneuverability and light weight bolster self-assurance and encourage independent activity. When a wheel chair is indicated, you can suggest an Everest & Jennings chair with confidence.

There's a helpful authorized dealer near you

EVEREST & JENNINGS, INC., LOS ANGELES 25

FOR ELECTRODIAGNOSIS IN NEUROMUSCULAR DISEASE AND TRAUMA
• Electromyography: the display, aural monitoring and recording of electrical activity of motor units
• Nerve conduction velocity tests
• Other studies of stimulus-evoked motor unit electrical activity
: Lower motor neuron and associated muscle fibers

This new compact instrument includes sensitive high gain amplifiers with new simplified calibrator, loudspeaker, flat-face seven inch cathode ray tube, a versatile synchronized stimulator for conduction time tests and everything necessary to make electronically synchronized, ten second Polaroid® records of all tests with push-button simplicity.

The new Model B includes electronic circuitry of proven success in the TECA TE Series console electromyographs. The amplifiers have excellent artifact rejection, wide frequency response, and include an effective powerline artifact rejection filter. The new nerve conduction velocity facilities include time marker pulses superimposed electronically on the recording beam. This permits accurate direct measurements of conduction time. Conduction velocity testing is further simplified by the unique new stimulator electrode which now contains the stimulus intensity control. This expedites testing when working without assistance. Adjustment of stimulus pulse duration, rate and delay permit a wide range of testing applications.

A new rigid mount positions the camera away from the operator when not in use and permits rapid positioning of the camera for recording. The camera mount serves as a convenient carrying handle when transporting the electromyograph.

An accessory 2-channel magnetic tape recorder with special electrical characteristics for recording electromyographs is in preparation for the Model B. One channel for electromyography will play back thru the cathode ray tube and loudspeaker. The other channel will handle verbal notes.

The TECA Model B Electromyograph has been soundly engineered as a complete single unit instrument to provide accurate, consistent, reliable clinical results with a minimum of instrument manipulation. Considerable flexibility has been retained to permit wide application to all types of current and future diagnostic problems.

Write or phone at our expense for additional information or demonstration.

TECA CORPORATION
80 MAIN STREET, WHITE PLAINS, NEW YORK

The TECA TE-Series Electromyographs are of modular design for maximum versatility. One or two channel models contain integral two-channel magnetic tape recorders. Special multi-trace photorecording features and direct reading time indicators are available with this series.

THREE QUALITY MEDCO PRODUCTS

to save you TIME and MONEY . . . and EASE YOUR PERSONAL WORK LOAD

the *Medcolator* MODEL G with GALVANIC

Has alternating, interrupted, modulated current of high or low frequency, superimposed on a rectified current. It incorporates three settings, Pulse, Surge and Tetanizing. The galvanic current and the Medcolator current may be used individually or simultaneously. Two other models also available.

the *Medco-sonlator*

Provides complete facilities for combination of Electrical Muscle stimulation and Ultrasound in one convenient cabinet. The use of Electrical Muscle Stimulation and Ultrasound, simultaneously applied, through the same sound head applicator, offers a diagnostic as well as combination therapy not possible with either therapy individually.

NEW

the *Medco* KOL-THERM

Provides an entirely **new** approach to one of medicine's oldest therapies, producing instantaneous moist or dry cold or moist or dry heat. The temperature range extends from approximately 30° to 130° with contrast therapy available and with completely automatic operation.

Medco equipment has wide medical acceptance by individual physicians, clinics, hospitals and industrial plants.

Now, the new **KOL-THERM,** for the instantaneous application of heat or cold, is also receiving an enthusiastic welcome. Medco trained personnel works with each physician and his assistants teaching them the operation of the equipment until it becomes second nature. The operation of the equipment by an assistant relieves the physician of a heavy portion of his daily work load.

A convenient coupon, at the right, may be marked and mailed for complete information or an office demonstration of any Medco equipment.

"Serving the Profession Since 1932"

MEDCO ELECTRONICS COMPANY, INC.
Division/Medco Products Co., Inc.

3601 E. Admiral Pl.
Dept. APMR 2/
P.O. Box 3338
Tulsa, Oklahoma

☐ I would like an office demonstration of your.....

☐ Please send me your illustrated literature on the.....

NAME.....

ADDRESS.....

CITY.....STATE.....

IF YOU ARE

. . . . . a clinician
. . . . . a research worker
. . . . . a physiologist
. . . . . a bio-physicist
. . . . . a teacher of physical medicine and rehabilitation

IF YOU WANT

. . . . . to stay abreast with what is new in physical medicine and rehabilitation

YOU MUST

. . . . . read the **Archives of Physical Medicine and Rehabilitation,** the official journal of the American Congress of Physical Medicine and Rehabilitation and the American Academy of Physical Medicine and Rehabilitation

. . . . . no other medical periodical gives you as broad a coverage in the field of physical medicine and rehabilitation . . . each month you will find in this journal informative articles on new developments, theories and practices dealing with all phases of this specialty

YOU ARE INVITED

. . . . . to send in your subscription today. Sample copy will be sent on request. Subscription price $8.50 per year; Canada, $9.50; elsewhere, $14.00 the year. Bill later if you wish. Return the coupon with your instructions.

AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION

30 No. Michigan Ave., Chicago 2.

Please find enclosed check for $_____ ☐ or bill me ☐ for one year's subscription to the ARCHIVES.

Name_____

Address_____

City, Zone and State_____

"Just 24" low, that's all!"

LO·BOY
WHIRLPOOL BATH

... THE WHIRLPOOL WITH THE LOW TANK PROFILE

Longer and wider, too — room enough for any patient, small or large. Gone is that old problem of getting patients in or out of whirlpool tanks. The **Lo • Boy** makes entry and exit easier and safer. Consider these other advantages: greater patient comfort/increased therapeutic benefits/simplified patient handling/ideal for children full body treatments/efficient for burn cases . . . You'll agree, too, that the **Lo • Boy** belongs in your physical therapy department.

(available in 52" and 60" lengths — 18" deep, 24" wide — mobile or stationary styles . . . literature mailed on request)

WHITEHALL ELECTRO MEDICAL CO.
DEPARTMENT A
19 WALL STREET • PASSAIC, NEW JERSEY

LO • BOY STANDARD

SINGLE AND MULTI-CHANNEL
ELECTROMYOGRAPHS

Console Model 201A-1

- *conduction velocity unit (built-in)*
- *low-noise, high-gain pre-amplifiers*
- *muscle identifier-stimulator (built-in)*
- *electronically synchronized photography*
- *controlled-width sweep circuit*
- *choice of oscilloscope features*
- *wide range of frequency response*
- *loudspeaker audio output*
- *single or dual tape recorders*

Free medical, engineering consultation. Immediate delivery — fully guaranteed.

Write Dept. J for specifications today.

MEDITRON®

A Division of Crescent Engineering & Research Company
5440 North Peck Road • El Monte, California
Eastern Office: Box 98, Pembroke, Mass. • CY 3-7201

special article

Management of Lower Extremity Amputees

Allen S. Russek, M.D.
New York City

● In this study, each part dealt with is a broad subject in itself. Some details were explored in the area of indications and surgery of amputations. As consultants, physiatrists are called upon to advise surgeons in the realm of rehabilitation so that a familiarity with the advantages of amputation and its technic are essential. Elementary details and controversial material have been deliberately eliminated so that this review represents the middle ground of common knowledge and accepted practice. An attempt has been made to demonstrate the place of amputation surgery in rehabilitation. Management of the amputee was presented as a step-by-step procedure under continuous medical supervision. Principles of pre-prosthetic preparation, prescription and training have been placed in their perspectives, pointing out that these are not isolated activities but part of an over-all correlated program.

It is estimated that one out of each 200 persons in the United States has had a major amputation and that of these about 700,000 are in the lower extremities. Additional amputations are being performed at the rate of 35,000 annually. The continuing supervision of these new and old amputees constitutes an appreciable medical responsibility in which the medical profession as a whole has only recently developed a deep interest.

A variety of clinical pathologic states terminate in amputation with its characteristic disability. This disability is somewhat of a clinical paradox since it is the end result of the treatment; the pathology having been removed, whereas, in most other disabilities one can still demonstrate the pathology or its residuals. The amputee, then, is an otherwise healthy individual (particularly the traumatic amputee) with an isolated physical defect. This would seem to be the ultimate objective of the surgeon who amputates. The successful, uncomplicated amputation at any level leaves the patient with a reasonably good potential for prosthetic restoration and ambulation. Unfortunately all amputations are not successful and uncomplicated so that a great number of patients have exchanged one kind of pathology for another, resulting in a disability which may be difficult or impossible to lessen by prosthetic means. In the course of this discussion it will be noted that some failures and complications are preventable by systematic, informed management.

The indications for amputation fall into several groups:

1. *Peripheral Vascular Insufficiency.* This is the largest group and accounts for about 60 per cent of all amputations in the lower extremities in peace time. A variety of causes for circulatory failure lead to amputation. The most common are related to diabetes, Buerger's disease, arteriosclerosis, emboli, massive arterial thrombosis, arteriovenous aneurysm and others, all of which have failed to respond to medical or lesser surgical procedures.

2. *Trauma.* Severe injuries with massive loss of tissue and destruction of blood supply may require immediate amputation. Many crushing injuries which appear at first to require amputation can recover if the blood supply is not destroyed. Most surgeons debride such wounds and wait until specific indications present themselves to the point where surgical or orthopedic reconstruction can no longer offer hope for viability or function.

3. *Malignant Tumors.* Benign tumors may occasionally require amputation if removal of the tumor is not possible without serious impairment of blood and nerve supply. When malignancy has been positively diagnosed,

amputation should be accomplished high enough to prevent local recurrence whether metastasis is present or not. Most of the high proximal amputations such as hip disarticulation and hemipelvectomy are performed for malignant tumors.

4. *Nerve Injuries.* Many individuals derive satisfactory function from a limb in which there has been motor and sensory paralysis. An anesthetic limb over which a patient has little or no control, however, frequently develops pressure or friction phenomena of which he is not aware for some time. Amputation of such limbs is indicated when repeated ulceration and infection have developed beyond medical control and constitute a threat to the patient's health and function.

5. *Infections.* Chronic osteomyelitis which has persisted in spite of repeated surgery ultimately disables the patient completely and constitutes a serious threat to general health. Many amputations are necessary even if the osteomyelitis ultimately becomes quiescent. Repeated surgery in the foot for long standing osteomyelitis most often leaves a functionless member. Amputation and a well-fitted prosthesis are superior functionally, cosmetically and physiologically. Gas gangrene infections may require early, high amputation as a life saving measure. Other infections which may lead to loss of muscle substance and function as well as impairment of sensation not uncommonly result in amputation.

6. *Thermal Damage.* Amputations for burns may be performed early or late depending upon the extent of initial destruction or subsequent deformities and loss of function. Cold injuries are insidious in nature and usually require amputation for interference with blood supply. In these instances the site of amputation will be dictated by the lines of demarcation in the presence of gangrene. Cold injuries may be accompanied by such intractable pain that standard major amputation through the leg may become necessary. In other cases similar amputation may be required for progressive fibrosis of soft tissues and persistent neuritis.

7. *Congenital Malformations.* Congenital malformations are not uncommon, such as absence of the femur or tibia or a rudimentary limb at the end of which there is an apparently normal foot. When the maldeveloped limb approximates the length of the other leg there is a tendency to perform operations to preserve the weight-bearing characteristics of this limb so that the foot may be used functionally. Unfortunately even after successful, repeated surgery in childhood the growth discrepancy in time between the two lower extremities may be considerable. The reconstructed, deformed limb may be three to 12 inches shorter than the other side, necessitating the use of a cumbersome brace and foot extension or a prosthesis. In most instances the knee levels do not correspond and the device carries a locked knee for walking. The principle of prophylactic amputation in infancy, depending on the nature and extent of the deformity, should be considered in many cases. This could spare a child the repeated, futile surgery over a period of childhood years during which he may only be intermittently functional with a brace or prosthesis. A standard level amputation and functional prosthesis early is cosmetically, socially, psychologically, and financially superior to the end results of even successful surgery in many of these cases. If the surgeon can plan to equalize leg lengths by epiphyseal retardation on the sound side concomitant with surgical reconstruction of the maldeveloped limb, the end result could be more acceptable.

8. *Congenital Absence of Limbs.* Some persons are destined to be amputees throughout their lifetime. Many congenital amputees have rudimentary structures at the terminal portions of their stumps. If these serve no useful purpose, or interfere with the fitting of

a prosthesis, they should be removed and the stump reshaped.

9. *Cosmetic Amputation.* Many children grow into adult life with damaged or deformed limbs which have been sufficiently functional during childhood and adolescence. When they face the realities of life and become aware of their variations from the normal, in terms of their awkwardness, poor cosmetic appearance of an atrophied limb and flail foot (as in poliomyelitis), vocational handicap and social unacceptability, they often seek amputation. The remarkable cosmetic, aesthetic, social, vocational, emotional, and personality improvement after amputation and prosthetic restoration in many cases justifies cosmetic amputation.

Considerations in Amputation Surgery

The level and method of amputation are determined by the specific indications. These may be quite different in cases of violent injury, malignant tumor or chronic osteomyelitis. It is not within the framework of this study to discuss emergency surgery or open amputations. The discussion will be limited to elective amputations to the extent that the principles of handling the various tissues of the limb will be brought out rather than the step-by-step procedure of performing any operation.

The first consideration after amputation is indicated is the level of amputation. The classical "sites of election" have in recent years become obsolete even though modern prosthetic technics can fit any amputation at any level. It now is considered proper to save all length with four exceptions:

1. Avoid partial foot amputations other than transmetatarsal; the partial foot amputations have outlived their usefulness. The results are not efficient weight-bearing members and require a bulky, cosmetically-poor prosthesis with which the ultimate function is not as good as it is with a more proximal amputation.

2. Avoid the lower third of the leg. The long lever contributes nothing to stability, interferes with standard methods of fitting, and the circulation in this area, already depressed, may be further impaired in a prosthesis. The formation of a shapely ankle is not possible with a very long, below-the-knee stump.

3. Avoid the proximal two inches of the tibia. This results in a short, broad, squared-off stump which cannot be adequately fitted. The lever is too short to preserve the knee functions and it is difficult to keep the stump from coming out of the socket.

4. Avoid the distal four inches of the femur unless an end-weightbearing stump is desired. End-weightbearing is a great advantage and should be accomplished whenever possible and feasible. Those long stumps in the supracondylar area, which have exposed the medullary cavity of the bone and cannot be used for end-weightbearing, are a source of difficulty. They are hard to fit, require outside knee joints which cannot be adjusted for friction, disturb the symmetry of the levels of knee motion, and interfere with gait.

The optimal sites of election may be simplified, to consist of:

1. Partial foot (transmetatarsal only): if it becomes infected, it is not worth trying to salvage.

2. Symes: this is the best below-knee level if it is done properly. It is not advisable in young women and may be objected to by all women because of the poor cosmetic factors.

3. Below-the-knee: the ideal level is in the middle third of the leg.

4. End-weightbearing: above the knee, including disarticulation, when specifically indicated.

5. Above the knee: from four inches above at any level, preferably mid-thigh.

In elective amputations, the handling of individual tissues may determine the degree of success with the prosthesis.

Skin. The flaps should be planned so that closure will be adequate and they will not require to be brought together with tension. The scar should be placed where it will not come in contact with

socket of a prosthesis or be subjected to other pressures or tensions. In standard above- and below-knee amputations, the scar is placed sligthly posterior to the bone at the end of the stump.

Fascia. The fascia is divided after the skin flaps are formed at an offset level, so that the deep and superficial suture lines will not be in contact. The dissection should avoid a line of cleavage between the fascia and superficial structures, since the blood supply to the flaps may be interfered with. Fascia should be closed as a separate layer. A fascial defect permits adherence of the flap to muscle or bone. Above the knee it may preclude the use of a suction socket by failing to prevent localized edema. The long posterior fascial flap in below-the-knee amputations should contain a thin layer of muscle.

Muscle. The muscles are used to pad the bone and shape the stump. Wedges should be removed when necessary to create tapering of the end of the stump. Muscles must be anchored to the end of the bone but not beyond it and never to each other over the end of the bone. Muscles which are not anchored retract and change the shape of the stump. This creates a formidable fitting problem. Too much muscle at the end of the stump must be avoided. Muscle becomes fibrotic and hard in this location and is a source of obstruction to comfortable socket fitting. Muscles which are used after transection should be carefully attached near the end of the bone so that they will function, such as the hamstrings and the adductor magnus. The tension of these muscles should balance their opposers. If the anterior structures, such as the rectus femoris, are too tight there may develop an incorrectible flexion contracture at the hip.

Bone. The bone should be cut parallel to the ground at all levels with the limb in weight-bearing line. The front of the tibia should be beveled to avoid a sharp angle anteriorly. The fibula is divided about an inch higher than the tibia. In children, the fibula should be shortened even more because it tends to outgrow the tibia. In thin patients, the lateral cortex of the fibula should also be beveled. The cortex of cut bone should be gone over gently with a file to separate loose fragments. All bone debris and bone dust should be thoroughly washed from the wound with normal saline. The periosteum must not be roughed up because, if it is, it produces bone later on. One may use one or two cuts in the periosteum as long as a clean-cut edge remains. A small ring of aperiosteal bone will not sequestrate in the absence of infection.

Nerves. These should be gently drawn down and cut with a sharp blade. They should retract at least an inch upwards out of the area of scarring. Nerves incorporated in scar tissue produce severe symptoms. Neuromas which later form will not become symptomatic if they lie free in an elastic bed. It is not necessary to tie or inject nerves. Large nerves containing a vessel may be tied, but no tighter than is necessary to control bleeding without cutting through the axons of the nerve. Nerves should be cut above any level at which they may have been grasped with a clamp.

Vessels. Arteries and veins should be tied separately. Adequate hemostasis is good practice in all surgery, but in amputations it is especially important to avoid a massive hematoma at the end of the stump. Since muscle oozing cannot be avoided, it is advisable to use a drain for 48 hours. Many surgeons do not use drainage since they believe that with antibiotics infection can be avoided, and others feel that a drain is a corridor for infection. The purpose of the drain is to avoid formation of a large hematoma and, at the same time, to allow fat, bone marrow and bone debris to escape from underneath the flaps. The stump which is not drained usually develops a hard end which persists for months and delays fitting. As for infection resulting from the use of the drain, one can only say that this is controllable and is not a valid objection.

In re-amputation, after open surgery or because of failure to observe some of the points mentioned above, the principles apply if the re-amputation is high enough above the previous level. In revision of soft tissue only at the end of the stump, the previous internal scars should be disturbed as little as possible.

Preparation of the Amputee for a Prosthesis

Following World War II a considerable volume of information relating to the care and management of amputees before and after obtaining a prosthesis appeared in books and medical journals. These writings were based upon excellent, extensive experience in the rehabilitation of healthy, young, male amputees. The standards developed for military personnel, however, have become somewhat tangential to the broad requirements of present day civilian amputees since only a small fraction of them are healthy, young men.

It is estimated that upwards of 75 per cent of the major lower extremity amputations are performed on individuals in the "older age" group. This factor has drastically altered the objectives of pre-prosthetic and gait training.

While it is still possible to compare amputee performance with the non-amputee in some cases, the achievement of "normal" function has become an obsolete concept for the great majority of amputees. The details of functional achievements will be dealt with separately but it will be recognized that the extent of preparation and training depends upon individual potentials, rather than on adapting the amputee to methods and procedures theoretically leading to "normal" function.

There are two components in the pre-prosthetic period: the stump and the physical status of the patient as a whole.

The Amputation Stump

The ideal amputation stump is one which is free from pain, adequate in length (middle third of thigh or leg), tapers distally, is firm and strong, has freely movable skin throughout with the scar on the distal end and which the patient can control through the full range of motion.

Towards achieving these attributes, there are three distinct objectives in the pre-prosthetic management:

a. Range of motion

b. Shaping and shrinkage

c. Strengthening and conditioning

Range of Motion. Most patients have a disinclination to move the amputation stump for a few days following surgery. During this period it is advisable to outline in detail to the patient the immediate objectives and to assure him that he will be capable of participating in the necessary activities. He should be informed with regard to bad posture, general body alignment and the importance of stump extension. He should be encouraged to perform active movements and isometric contractions of muscles as soon as these are comfortably tolerated. It will be found that there is great variation among individuals to tolerating early movements. Active movements within the first week, even through a few degrees, are desirable. This develops the "muscle sense" within the stump and sets it up as a new entity. It separates the stump from the phantom, and minimizes phantom fixation. The patient also should be instructed in moving the foot and toes of the phantom after explaining the significance of the phantom. This prevents the phantom foot from assuming a fixed or distorted position.

After two weeks it is necessary to increase the active range of voluntary movements. These are always self limited by discomfort and will not jeopardize healing of the wound. By this time the patient should have acquired the ability to maintain the extended position of the stump without pain and to discontinue the flexed attitude which in the first week was so comfortable. If this is not achieved, passive and assistive extension exercises are permis-

sible to prevent flexion contracture. The use of a splint usually is not necessary for preventing contractures but may be very useful for maintaining the support of redundant soft tissues beyond the end of the bone when present.

By the end of the third week the sutures should be out, the patient out of bed at will and moving the stump actively through full flexion and extension. Above-the-knee stumps should by this time be actively moved in all directions without much discomfort. Muscle setting routines should be carried out several times daily. When a flexion contracture is present, the passive exercises should be gentle but prolonged—such as the use of sand bags, face lying and gentle splinting. Tension forces through the operated tissues are not tolerated well until after six weeks and may result in pain, swelling and loss of range.

Shaping and Shrinking. The postoperative dressing is usually massive with uniform, gentle compression. This is to protect the stump, offer token splinting, support the circulation, minimize massive swelling and hematomas and cut down muscular movements. Such a dressing may be maintained for 10 to 20 days until the sutures are removed and the scar closed. Increase in compression for purposes of shaping and shrinkage begins after the fourth or fifth week, depending upon the stump reaction. There is no advantage in earlier firm compression.

Amputation stumps shrink in size for about two years due to selective atrophy and adaptive tissue changes. Early shrinkage occurs at a faster rate than late shrinkage. With adequate control of the stump for four to six weeks, beginning in the fifth week after amputation, 50 per cent of this shrinkage can be developed so that the stump volume will not suddenly undergo extensive changes when weight is placed in the prosthesis.

The elastic stump shrinking sock in proper size which compresses with a resistance of about 30 mm. of mercury is a good starting mechanism. After three weeks of the use of the sock, the elastic bandage should be used, not to exceed 60 mm. of pressure. The pressure can be tested by first applying a blood pressure cuff about the stump and pumping it up to five millimeters. The cuff and stump are then wrapped and the tension with which the bandage is applied can then be judged by the height of the mercury column. It is not difficult to apply an Ace bandage as a true tourniquet.

Shaping is accomplished by recurrent bandaging over the end of the stump with slightly more compression distally. The important thing in above-knee stumps is to apply the compression uniformly over the entire stump as high as possible so that proximal shrinkage about the fitting circumference is adequate. Some patients may require actual weightbearing to shrink adequately. This is done with leather shrinkers or weight-bearing plaster of Paris or wood socket pylons. Occasionally a temporary articulated prosthesis may be required for this purpose. The weight-bearing pylons are particularly effective for shaping the stump with prominent "dog ears," or the cylindrical shaped stump.

It should be remembered that the elderly patient with wrinkled skin and flabby stump may not respond to any of these methods and the stump may remain flabby and soft for years, even while wearing a prosthesis.

Strengthening and Conditioning. Strengthening and firming of the stump is carried out according to individual needs. Young patients are usually already strong and firm and require only a basic program of maintenance exercises including resistance. Resistive exercises can be added to the range of motion exercises after the scar has stabilized—that is, after six weeks. Every patient whose potential for use of the prosthesis is good should have resistive exercises to achieve sufficient power to control the prosthesis. This does not correspond to the power necessary for the non-amputee to control the center

of gravity over his own limb. The persistent participation in power building exercises for amputees has been far overdone. The requirements are rather simple. In below-the-knee cases the quadriceps should be competent to extend the knee with the prosthesis on in the sitting position. In above-the knee cases the gluteus maximus and hamstrings require the strength. The gluteus medius is no longer required to hold through controlling the pelvic level but is used only to exert lateral pressure against the wall of the prosthesis. Transfer of the weight to the ischial ramus relieves the adductors and abductors of the major need for sheer power.

Amputees should be encouraged to handle the stump freely and to knead it manually for conditioning purposes. This is useful in preparing the stump for the mechanical soft tissue stresses associated with wearing a prosthesis.

The amputation stump is not ready for measurement until the soft tissues have reached a state of uniform consistency. Hardening at the end of the stump or flabbiness proximally are commonly seen but should be overcome before using the prosthesis.

Patients who obviously do not have the physical stamina to derive more than minimal use of a prosthesis with crutches should not be placed through an extensive stump preparation regime. The concentration of effort should be directed to the upper extremities and the remaining leg.

The Physical Status of the Patient as a Whole

With the increasing incidence of amputations in older people there is an increasing significance to the general physical status of the patient prior to prescribing a prosthesis.

The vascular diseases which result in amputation of one limb also involve the other limb and may be generalized. For this reason diabetes and all other chronic illness need to be brought under control, labile blood pressure must be stabilized, and cardiac status should be established as adequate for gait training strains.

The unamputated limb must be made muscularly adequate and competent from a vascular standpoint for walking. Postural exercises to maintain the body segments in alignment and eliminate lordosis, general conditioning exercises and preparation of the upper extremities for the use of crutches are essential in elderly patients. Progress may be slow but nothing should be forced in order to prevent cardiovascular or circulatory embarrassment.

The general conditioning program may also include Buerger's exercises, standing balance, crutch walking on the remaining limb, hopping, and Activities-of-Daily-Living training.

One must be constantly aware of the physical limitations in the presence of advancing age, avoiding over-activity, fatigue, and low endurance levels.

The Amputee

Personal factors are of greater significance in the management of amputees than they are in the disabled from other causes. The reason is that the pattern of treatment, the extent of the program, the prescription for the prosthesis and the degree of success are all dependent upon the amputee as a person. In relationship to the prosthesis, one must be conscious not only of what is being fitted but also who is being fitted. Factors to be considered are:

1. *Age.* As people grow older their tolerance for physical exertion diminishes. Since pre- and post-prosthetic training are based largely upon repetitive activities with relatively high energy cost, it must be expected that most older age amputees will not develop great skill with a prosthesis. Indeed, many do not have the physical capacity to tolerate the preliminary activities prior to consideration for a prosthesis.

There is a direct correlation between age and prosthetic performance. The age band from 55 to 60 appears to

divide the younger from the older group.

For any amputee over the age of 60 the first consideration should be to investigate the past and present medical history as a base line for determining how much physical activity he will be able to tolerate—and test him to be certain that his tolerance will not be exceeded.

2. *Sex.* In general, female patients achieve lower levels of function than males. Female amputees definitely have a lower threshold for sustained activity with prostheses.

3. *Occupation.* Much of the value of a prescription for a prosthesis depends upon the elements which meet specific needs on an individual basis. The most adequate prescription is one which is written with the knowledge of what the amputee is required to do with the prosthesis and what his potential is for doing it.

Modifications in the prosthetic prescription are made according to occupational needs for sitting work, standing, walking, or combinations of these. The alignment, stability, comfort and cosmesis in the working position are all taken into account.

4. *Psychologic Factors.* The emotional status and degree of acceptance of the disability will determine the training rate and potential achievement. These, in turn, will have an influence on the prosthetic prescription.

In all phases of management of the amputee it is necessary to have his cooperation, based upon insight, motivation and hope. Patients do not readily lose their self pity, fear and feeling of hopelessness without guidance. Before or shortly after amputation the patient is indoctrinated in what it means to be an amputee, what procedures he will participate in, and what the possibilities are for restoration of function. He also should be informed that there is a direct relationship between achievement and cooperation. All personnel involved in the rehabilitation of the amputee should maintain a continued atmosphere of encouragement and hope, without suggesting or offering more than the individual is expected to accomplish. It is important to point out the limitations of each amputee so that his ultimate goal will be realistic and acceptable.

5. *Economic and Social Status.* The drive for physical restoration and return to productivity is a powerful force which motivates amputees in varying degrees. It is a well known and interesting observation that disabled patients work hardest for recovery when there is a home and someone who loves them waiting. It is gratifying and often surprising to see how much cooperation and enthusiastic participation is demonstrated by older amputees under these circumstances. There is, however, a large population of older amputees without homes, family or friends. The experience with such medically and socially indigent people at Bellevue Hospital has been extensive. It was found that when the amputee had no one to perform for and no place to go, he became completely dependent and passive. Only a small percentage of the indigent older age amputees ever succeeded in functioning well enough with a prosthesis to live alone and independently outside of a hospital. These are disposition cases for chronic disease hospitals or nursing homes and in most cases are not provided with a prosthesis.

Older amputees who are economically and socially secure do very well. Over 80 per cent of private cases in this category achieve acceptable function with a prosthesis and live outside of institutions.

Classifications of Achievement of Amputees with a Prosthesis

In a recently completed follow-up study of 1,000 amputees in the Bellevue Hospital Amputee-Prosthetic Clinic, supported by the Office of Vocational Rehabilitation of the Department of Health, Education and Welfare, one of the important factors analyzed was the degree of function in each case. There was so much variation of function in each group that it became nec-

essary to call in 100 single above-knee amputees for gait analysis and estimation of function. This was a detailed study aimed at identifying the specific factors which supported or retarded function.

There were three segments to the evaluation, in each of which there were positive factors which supported and negative factors which retarded function: the amputation stump, the patient, and the prosthesis.

The Amputation Stump

Positive

- Adequate length
- Full range of motion
- Proper shrinkage and shaping
- Freedom from pain
- Scars not adherent
- Neuromas not symptomatic
- Adequate muscular strength

Negative

- Very short stump
- Painful scars or neuromas
- Adherent or irregular invaginated scars
- Flexion contracture at hip or knee
- Muscular weakness
- Fatty, flabby or redundant soft tissues
- Indurated scar tissue or infection

The Patient

Positive

- Emotionally stable
- Cooperative
- Under 55 years of age
- Free from chronic, degenerative diseases
- Nonsymptomatic remaining limb
- Ample physical tolerance for activity

Negative

- Emotional depression
- Poor cooperation or motivation
- Age above 60
- Advanced arteriosclerosis, diabetes, cardiovascular insufficiency or symptomatic remaining limb owing to vascular insufficiency, arthritis, deformity, neurologic weakness or ulceration.
- Lacking in physical stamina

The Prosthesis

Positive

- Comfortable, adequate fit and alignment
- Appropriate modifications for specific reasons
- Demonstrated adequate preprosthetic and skilled gait training
- Free from fear of falling

Negative

- Malfit
- Painful weightbearing
- Rapid early shrinkage
- Unstable alignment
- Lack of stability components
- Insufficient gait training
- Excessive weight of limb
- Discrepancies in length
- Fear of falling

A questionnaire was filled out by each patient relating to all activities. The answers, combined with the physical examination and gait analysis, developed a consistent pattern so that definite graduations of function could be classified.

Classification of Function with a Prosthesis

- Class I—Full restoration
- Class II—Partial restoration
- Class III—Self care plus
- Class IV—Self care minus
- Class V—Cosmetic plus

Full Restoration. Class I function is achieved with a prosthesis by those who are not handicapped by their disability. These amputees could work at their regular jobs, participate in all social activities, and engage in limited sports. These individuals stated that there had been no alterations in their social, domestic, vocational or recreational life because of the amputation.

Partial Restoration. Class II function is achieved when the handicap consists only of restricting certain activities, such as dancing, sports, hiking, etc. These amputees could perform their regular jobs with few exceptions.

Self Care Plus. Class III function indicates that with a prosthesis the amputee is completely independent and more. Job modification is often neces-

Fig. 1 — Courtesy of Prosthetics Education New York University Post Graduate Medical School.

Prescription Form—Lower Extremity Amputee

Patient's Name_____ Date_____

Amputation Type: Right_____ Left_____

Hip Disarticulation_____ Short A/K_____ Medium A/K_____ Long A/K_____

Knee Disarticulation_____ Short B/K_____ Medium B/K_____ Long B/K_____

Syme_____ Other*_____

MEDICAL AND SURGICAL PRESCRIPTION

1. Is surgery indicated? Yes_____ No_____ if so, please specify condition and indicate treatment_____

2. Is pre-prosthetic therapy indicated? Yes_____ No_____ If so please give detailed prescription and intended result_____

3. Should fitting be delayed for any reason? Yes_____ No_____ If yes, why

PROSTHETIC PRESCRIPTION (Consider vocation, avocation and patient preference, as well as stump and general physical characteristics.)

1. Above-Knee
   a) Socket : Quadrilateral_____ Plug_____ Other*_____
   b) Socket Material: Wood_____ Other*_____
   c) Alignment : Basic_____ Modified_____ Please explain modifications:
   d) Suspension : Suction_____ Non-Suction_____
      Silesian Bandage_____ Pelvic Belt_____ Other*_____
   e) Knee : Single Axis_____ Other*_____
   f) Extension Aid : No_____ Yes_____ Indicate Type_____
   g) Shank : Wood_____ Other*_____
   h) Ankle : Single Axis_____ SACH_____ Other*_____
   i) Foot: : Wood_____ SACH_____ Rubber_____
      Hinge Toe_____ Felt Toe_____ Rubber Toe_____ Other*_____

Indicate reasons for any modification of basic prescription (wood quadrilateral socket, single axis knee, wood shank, SACH foot or single axis ankle with wood foot)

2. Below-Knee
   a) Socket : Patellar Tendon Bearing_____ Other*_____
   b) Socket Material: Plastic_____ Other*_____
   c) Alignment : Basic_____ Modified_____ Please explain modifications:

d) Suspension : Knee Strap_____ Waist Belt_____ Thigh Lacer_____ Other*_____

e) Shank : Wood_____ Other*_____

f) Ankle : Single Axis_____ SACH_____ Other*_____

g) Foot : Wood_____ SACH_____ Rubber_____

Hinge Toe_____ Felt Toe_____ Rubber Toe_____ Other*_____

Indicate reasons for any modification of basic prescription (patellar bearing socket, knee strap suspension, plastic covered wood shank, SACH foot.)

_____

_____

_____

_____

*When prescribing "Other," please specify exactly what is intended.

sary and most of the persons in this group will perform seated, indoor work. Many in this group will use a cane to relieve stresses of walking. Social activities are reduced and most sports eliminated, but no help is required from another person.

Self Care Minus. Class IV is the function of those amputees who, with a prosthesis and training, fall short of taking complete care of themselves. They need help from another person in varying degree; sometimes for putting on the prosthesis, dressing, traveling or toilet activities. With the necessary help many of these amputees work if the job is seated and travel to work is not complicated. Most of these amputees use crutches and some cannot tolerate the prosthesis all day. An important factor in this group is fatigue so that sustained activities are to be avoided.

Cosmetic Plus. Class V function implies the achievement of little activity other than the wearing of the prosthesis itself. In general, this group is better off with a prosthesis than without one. The ambulation may merely consist of moving from one room to another with crutches. Insecurity, fatigue and discomfort are common. The effort of this low level performance may result in dyspnea and other evidence of cardiovascular strain.

The percentage of cases in these classifications from the Bellevue group are essentially without significance other than that the performance of the indigent patient is much lower than that expected from private patients. The 100 Bellevue cases consisted of patients who could come for followup as outpatients and were gathered from a much larger group. A comparative evaluation of 100 consecutive private cases of single above-the-knee amputees fitted with prostheses was also made. The results are as follows:

	Bellevue	Private
Class I	3	8
Class II	12	19
Class III	31	48
Class IV	33	20
Class V	21	5

The private statistics indicate that 75 per cent of single, above-knee amputees become independently ambulatory and functional.

Experience has shown that amputees do not overcome the restricting negative factors which alter gait and general activities. It also is observed that when more than one negative factor is present, the amputee is limited by the sum of these factors. For example, the amputee who has a painful stump with a flexion contracture at the hip is restricted not only by poor gait but also by lowered tolerance for walking.

Each negative factor relating to the stump or to the patient as mentioned above is of itself a retarding mechanism in the rehabilitation of the amputee. Since this pattern is constant regardless of the source of the patient, it can be used to predict the anticipated functioning capacity of the amputee *before* the prosthesis is ordered. The prescription for the prosthesis, therefore, should not be written without the specific in-

formation necessary to predict the classification into which the patient fits.

This is done by listing all of the negative factors found and using these as a guide to the classification. The patient with two negative factors will fall into Class III. The patient with four negative factors will function at Class V. Therefore the sum of the negative factors is subtracted one class at a time below Class I.

The above method has proved to be qualitatively accurate in five of the Amputee Clinics in the New York University Medical Center. This method has improved prosthetic prescriptions and eliminated excessive training. If it is estimated that a given amputee will achieve Class IV function, his gait training will be discontinued when he reaches that level. This will then be considered a successful case because the patient achieved his best potential, even though his performance is rather poor and he failed to reach complete independence. All patients cannot be trained for Class I or II function since in the majority of cases this is wishful thinking. The doctor, patient and therapist should know what the goal is and when it is reached. Below-knee amputees can be managed along the same lines but the classification of function is at least one grade higher than the above-knee amputees with the same number of negative factors.

There is a Class VI which consists of those patients who, after careful consideration, are not better off with a prosthesis than without one. These amputees have at least five negative factors as described above. Under these circumstances it is not feasible to prescribe a limb at all.

At this point it should be recalled that in discussing considerations of amputation surgery it was mentioned that some problems can be prevented in the operating room. It should be reemphasized that painful stumps, adherent and depressed scars and bulbous stumps interfere with function and lower the amputee's potential.

The Prosthetic Team

Since March, 1956, courses in lower extremity Prosthetics have been conducted in the Post Graduate Medical Schools of New York University, University of California at Los Angeles, and more recently at Northwestern University. As of June, 1960, there have been trained 810 physicians and surgeons, 660 physical therapists, and 532 prosthetists.

In most instances the physicians, therapists and prosthetists working in a given area were trained at the same time. This has resulted in the establishment of at least one trained group or team from virtually every state in continental United States.

These courses were the culmination of many years of research in design and development, fabrication, and curriculum planning. With concomitant progress in Surgery and Amputee Management, as well as training methods, the emergence of the Prosthetic Team was an inevitable development.

Since the rehabilitation of the amputee is not a one man job but a complex, multi-disciplinary activity, it became necessary to train the various personnel involved along parallel lines. Individuals from other disciplines are often added to the basic team of physician, therapist and certified prosthetist. They consist of other medical or surgical specialists, social worker, rehabilitation (or Public Health) nurse, pediatrician or vocational counselor.

The combined, cooperative effort of the members of the team has certain advantages. A well organized and functioning team inspires security and confidence on the part of the patient as well as the group. The composite views and opinions make for higher professional standards and establish the team as a consultant group for the community. At the same time it avoids duplication of effort, misunderstanding and time loss, while making it possible for the amputee to obtain the most suitable prosthesis for his needs.

It is to be hoped that the prosthetic teams throughout the country will find it possible to minimize the ever growing problem of more and more amputations on older and older patients.

Prescription for the Prosthesis

Progress in Prosthetics is sharply emphasized when it is recalled that the prosthetist of 10 years ago would be at a loss to fill a present-day prescription for a prosthesis.

Ten years ago only 20 per cent of prostheses were made on prescription, whereas today only 20 per cent are not —and most of these are replacements. This points up the magnitude of the progress made by the prosthetists during this period. The establishment of the American Board for Certification has converted the limb merchant and mechanic into a professional craftsman who provides not only a quality product but also a valuable professional service.

The maintenance of such high standards can only be sustained if the prescriptions for prostheses are written under circumstances of equally high professional standards.

The prosthetic prescription is one of the steps in the management of amputees and constitutes the bridge which spans the gap between surgery, convalescence and pre-prosthetic preparation, and restoration of function (table 1).

Table 1: Rehabilitation of the Lower Extremity Amputee

	6.... Rehabilitation	
	5.... Ambulation training	
	4.... B—Prosthesis	
3.... Amputee		1.... Full restoration
2.... Stump, General Preprosthetic		2.... Partial restoration
		3.... Self care plus
		4.... Self care minus
1.... Surgery		5.... Cosmetic plus
		6.... Not feasible

The timing of the prescription is of great importance since it not only has a direct bearing on the effectiveness of the prosthesis but also constitutes a strong psychologic impact on the amputee. This is the formula which will undo the catastrophe, the open door through which he will emerge as a whole person, the reward for all of the suffering, exercises, bandaging, practicing and preparation.

The timing implies that:

Step 1—The *surgical phase* is complete: healed stump, painless scars, movable skin, absence of infection, no further need for surgical care.

Step 2—The stump is adequately shaped and shrinkage advanced, the patient's medical and physical status stable.

Step 3—The amputee is ready physically, psychologically, socially and emotionally.

With the information available at this point the amputee's potential can be estimated and classified.

The prescription can now be written for *this* patient, with *this* degree of preparation, with *this* stump, to perform *this* level of function.

Under such a pattern of management the prosthetic prescription becomes highly individualized.

It is obvious, therefore, that a prescription for a type of prosthesis is not enough. The prescription should be broken down into the various components, each of which may serve this amputee best (Fig. 1).

A prosthesis consists of a socket, method of suspension, knee joint (in above-knee cases), shin, ankle and foot. In addition, there are auxiliary methods of suspension, extension aids, and joint locks.

Individualization in the prescription allows for a wide choice. The socket may be made of wood, metal, plastic, or even leather. The suspension above the knee may be accomplished by hip joint and pelvic band, suction or vacuum valve, Silesian belt, waist belt, shoulder harness, or combinations of these.

The knee joint may be of the single axis type with constant or variable friction, multiaxis or polycentric, positive friction locking or hydraulic. There are several available foreign made knee joints but they have no specific advantages over the commonly prescribed knees herein mentioned.

The shin is usually of wood but may be aluminum, plastic or a cosmetic shell according to specific requirements.

The ankle usually is of the single axis type with a foot, the movements of which are controlled by a heel or plantar flexion rubber, instep rubber (dorsiflexion stop) and a toe break.

The SACH or solid ankle cushion heel type of foot has recently been widely used. This consists of a one-piece foot with compressible wedge in the heel and a toe portion which dorsiflexes as weight is transferred to the forefoot.

Below-the-knee sockets may be of wood or plastic. The socket now being taught in the Prosthetic Schools is the Patellar Tendon Bearing closed end Plastic Socket with Soft Rubber Inner Socket. The method of cast modification which makes it possible to control weight and pressure distribution results in a firm fit requiring only a supracondylar strap or cuff for suspension. Other suspensions are thigh corset or elastic strap waist belt to cuff.

The prescription should be written for the simplest components which will meet the amputee's requirements. The basic above-the-knee prescription consists of a quadrilateral suction socket with single axis knee and ankle and standard foot, all in basic alignment. Basic alignment occurs when a line dropped from the greater trochanter through the ankle center passes slightly in front of the center of motion of the knee. From this basic prescription the individual modifications may be made, such as: alteration of socket contour for muscular or weak stump, additional initial flexion for the very short stump, change in suspension for the elderly patient, adding a Bock (positive friction locking) knee, polycentric knee or knee lock for persistent flexion contracture, and many other modifications which space precludes mentioning. It is obvious, however, that most patients will require some (even slight) socket modification. Modifications in alignment are made for the very long, very short, weak or flexed stumps. The solid ankle cushion heel type of foot should not be used on the first prosthesis for the patient who is not likely to put full weight on it. With crutches and partial weight, the SACH heel is relatively too hard and prevents the foot from delivering its construction advantages. It retards ambulation training and prevents the amputee from learning to place full weight into the limb. The weight of an above-knee prosthesis for the amputee in the older age bracket should be kept as low as possible. Above-knee limbs weigh between six and nine pounds. With special care or the use of treated Balsa wood, a sturdy prosthesis can be made weighing under four pounds.

The standard below-knee prosthetic prescription consists of a conventional wood socket with knee joints, thigh corset and single axis ankle.

This prescription is rapidly yielding to the Patellar Tendon Bearing Plastic Socket as the standard for below-knee amputees. This method of fabrication is becoming widely known, can be modified to accommodate to unusual situations and may be used with thigh corset suspension when necessary for knee stability or weight distribution above the knee.

Prescriptions for partial foot amputations requiring a prosthesis and the Syme stump as well as the hip disarticulation leave much less room for variation from the standard pattern. The Canadian Syme's prosthesis is a plastic end-weight-bearing socket with a posterior "trap-door like" segment to permit the bulbous end to enter the limb. Modifications of this prosthesis can be made for most partial foot stumps.

The hip disarticulation is fitted with either a "tilting table" socket with locked hip, polycentric knee and single axis ankle, or the Canadian type with transverse anterior hip joint and extension stop, single axis knee and ankle. The solid ankle cushion heel type of foot may be used in some cases and has distinct advantages for women. No joint locks are used with this prosthesis. It will be suitable and is to be preferred in the great majority of cases.

When prescribing for a long term, experienced amputee, caution should

be exercised in attempting to give this amputee something "better." Long term experience even with an obsolete, broken prosthesis is often impossible to break through. No drastic change in design or suspension should be offered to such patients unless a thorough discussion of the problems associated with the changes is held.

The responsibility for providing the appropriate prosthesis is the physician's. The physician who writes prescriptions should therefore establish a cooperative working relationship with a prosthetist or group of prosthetists whose advice, judgment and experience he may rely on.

Limb fitters now use adjustable alignment devices which eliminate guess work in setting up a prosthesis and positioning the foot. This creates a degree of uniformity and accuracy which minimizes servicing and adjustment after final fitting.

Every prosthesis should be subjected to an initial checkout before ambulation is started to prevent the prosthesis itself from retarding function, as mentioned before. If the prosthesis requires change or adjustment at checkout, these should be made before training is begun.

Ambulation and Gait Training

When the prosthesis is delivered the patient should be instructed in putting it on and taking it off. He may need advice on how to dress himself and where to obtain special clothing items when necessary. He requires specific advice regarding the care, cleaning, adjustment and operation of the prosthesis.

As training begins the amputee is reoriented with reference to his potential, specific limitations, objectives and method of training. If this is neglected the amputee remains frustrated and insecure.

In the act of walking the center of gravity is alternately supported by the lower extremities. The walking cycle consists of alternate heel contact, stance, toe-off and swing phases. A point of double support occurs at heel contact on one side and toe-off on the other. During double support the height of the person is lower than at mid-stance on one limb. This vertical displacement normally is a little less than two inches. As the center of gravity is shifted from one limb to the other there is a lateral displacement of a little less than two inches. Since these displacements occur simultaneously the center of gravity is traveling through an undulating, sinusoidal path within a two-inch square. This is a highly precise and remarkably efficient muscularly controlled activity. During this process the muscles controlling the trunk, pelvis and lower extremities participate in split-second phase contraction and relaxation in synergistic and reciprocal relationship. This conserves energy and moves the body forward smoothly. Anything interfering with control of the center of gravity (posture, alignment) or the competence of the muscles of an extremity will create an obvious alteration in gait. The well prepared, properly fitted, adequately trained unilateral amputee may walk with little, if any deviation from normal gait. This is the ideal objective for amputees whose protential of function is in Class I or II.

Ambulation and gait training as outlined here relates to the unilateral above-knee amputee since this is the most common and important patient to train. As it takes two limbs to walk with, each must be competent to perform its functions. One limb cannot make up for deficiencies in the other so that it is desirable to have the amputee safe, secure and functional with the unamputated limb while training. If this is not the case one must revert to the pre-prosthetic aspects of management and defer training.

If the patient is ready, training begins with control of the center of gravity. During this time he is also gaining proprioception by wearing the prosthesis and feeling the ground through it. Standing balance between

bars is practiced with the segments of the body in proper postural alignment. The abdomen is pulled in, lordosis diminished by pelvic rotation and weight is divided equally on both sides. Weight shifting from side to side with feet together and trunk flexion and extension are performed to develop tolerance for the prosthesis. Heel and toe rocking alternately with one foot a step ahead gives the feel of control of the knee. During this exercise the patient is taught to extend the stump with the prosthesis in heel contact position placing weight on the limb.

Alternate single steps forward and back create the rhythm of walking. The "step to" consists of a step with the normal leg and bringing the prosthesis up to it. The "step out" is a step with the normal leg, a step with the prosthesis and another step with the normal leg. This is the crucial point of training since it requires supporting the weight on the prosthesis, stabilizing the knee and deploying the weight from the heel to the toe. It is important to have the patient moving forward smoothly without stopping until he reaches the toe-off position with the prosthesis. After practicing this one-and-one-half cycle with stability the patient may then be encouraged to do a series of "step-outs" which constitutes walking. This is the ambulation phase of training.

Gait training is concerned with the manner of ambulating and leads to a more advanced series of exercises. At this point attention is directed towards equal length of steps. There is a tendency to take a long step with the prosthesis and a short one with the other leg. This should be corrected early in the training. It is helpful to have lines or foot prints painted on the floor and a full length mirror. The subject is to be instructed to look straight ahead and stop watching his feet. Knee flexion and heel rise are now concentrated on. When training is started the knee friction may be released or made tight, according to the ability of the patient to handle the prosthesis. It must now be adjusted to the speed of the gait which is developing. Increased friction and tight extension aids lead to circumduction of the prosthesis or vaulting on the other foot. Patients using the polycentric knee or positive friction locking knee must be taught to break the knee by first taking weight off the prosthesis. When the prosthesis is comfortable there should be little difficulty in practicing even cadence. This corrects the sudden, rapid, short step with the normal leg.

These exercises should be done repeatedly and deliberately until safety and confidence are certain. As progress is made there may occur gait impairments which can only be corrected in the prosthesis, such as rotation at heel contact, foot slapping, whips, knee buckling, etc. Prosthetic adjustments are made to prevent habitual defects.

This is the general way gait is supervised. There are other methods and many supplementary exercises with and without the prosthesis which are contributory to good training and good performance. Each patient will progress at his own pace so that there is no time table to follow. Patients who lag in progress are those who are known in advance to have lower potentials. The patients who do best require much less time than those who struggle for their low level potential function. The slow and older amputees do not require long practice periods to achieve the ability to put full weight on the prosthesis. The physician and therapist will recognize that these patients are failing and resort to the use of crutches. Most of these patients can learn stable three point or four point crutch gait as they may need. The patients who will walk well may advance from the parallel bars to independent gait without using crutches or canes. For these individuals there are a number of additional activities to be learned. These consist of stepping up and down a curb, stair climbing and descending, walking sideways, walking up and down an incline, bending and kneeling, stepping over obstacles, walking in a

circle, sitting down and rising from chairs and getting up from the floor. All of these are taught with technics which ensure stability of the prosthesis.

When a definite objective has been set and achieved, training should be discontinued. For those amputees who, at best, are functioning at a low level, time and experience can provide the necessary loss of fear and ultimate sense of stability.

During the training period and in follow-up contacts with amputees, an attitude of encouragement and praise will sustain the motivation to continue especially the slow patient for whom even small skills may be a long and arduous experience. Where a vocational objective depends upon function with the prosthesis, training in special activities may be necessary, such as driving a car.

Summary

The foregoing was written not as a contribution of new material to the voluminous literature on the subject but as a review for physiatrists. Each part dealt with is a broad subject in itself and much has been omitted. Some details were explored in the area of indications and surgery of amputations. As consultants, physiatrists are called upon to advise surgeons in the realm of rehabilitation so that a familarity with the advantages of amputation and its technic is essential.

Elementary details and controversial material have been deliberately eliminated so that this review represents the middle ground of common knowledge and accepted practice.

An attempt has been made to demonstrate the place of amputation surgery in rehabilitation. Management of the amputee was presented as a step-by-step procedure under continuous medical supervision.

The principles of pre-prosthetic preparation, prescription and training have been placed in their perspectives, pointing out that these are not isolated activities but part of an over-all, correlated program.

It is hoped that in the light of continuing research and advances in prosthetics, the physiatrist, with whom rests the major responsibility for the management of amputees, will meet this growing problem with increasing success.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Annual Conference

AMERICAN OCCUPATIONAL THERAPY ASSOCIATION

Sheraton-Cadillac Hotel

Detroit, Michigan

November 6-8, 1961

Trigger-Point Injection: Its Place in Physical Medicine

Albert L. Cooper, M.D.
Seattle

● The trigger-point phenomenon is an extremely common syndrome in the physiatrist's practice. An understanding of the pathophysiologic mechanism of the trigger point will enable the physiatrist to direct his prescription to the real source of trouble. Obviously, symptomatic treatment can meet with only partial success. Knowledge of the trigger-point phenomenon will aid the diagnostician in understanding otherwise inexplicable symptoms. The injection of local anesthetics to interrupt the vicious cycle of pain can materially shorten the time of recovery of patients suffering from the trigger-point syndrome. The technic should be an integral part of the armamentarium of every physiatrist.

Introduction

The "trigger-point" phenomenon, ably described by Dr. Janet Travell, must be well known by everyone specializing in physical medicine and rehabilitation. The recognition of this phenomenon in patients experiencing pain will permit the physiatrist to prescribe more intelligently than he might otherwise do, and to supplement physical measures with injection of local anesthetics to achieve superior results.

Livingston[1] and Gerard,[2] after exhaustive studies of the mechanisms of pain, agreed in concluding that chronic pain should be treated in two ways: (1) by blocking the nerve fibers that carry pain, and (2) by stimulating the normal input of the sensory nerves.

I can think of no better way to stimulate sensory input than a planned program of physical therapeutic procedures. Specialists in physical medicine can recall with satisfaction that they have been providing the recommended afferent stimulation by the physical and occupational therapeutic procedures which they have been prescribing.

In the light of the observations of Gerard and Livingston, it would seem prudent to reexamine our approach to the problems of pain, to determine whether those authors' first recommendation, of blocking pain fibers (trigger-point injection), should be an integral part of the procedures of physical medicine. Furthermore, investigation should proceed to determine whether the use of both methods would produce even better results than a single method does.

Definition

The "trigger point" is a discrete area of tenderness to pressure or to stretch, probably no greater than 1 mm. in radius, located in muscle, connective tissue or skin, in which the reaction to stimulation suggests an explosion in the nervous system (thus, the comparison to pulling the trigger of a gun). The violence of the reaction and its spread to distant areas are far beyond those which might be anticipated as a result of stimulation of normal structures. A trigger point actually is a physical sign discovered on examination, a localized spot of deep tenderness with a low threshold to deep pain (Travell[3]).

Cause

Trigger points may be built up gradually over a considerable period, but usually there is some immediate precipitating condition. Travell[3] has listed the following immediate and cumulative causes: sudden trauma to musculoskeletal structures; unusual or excessive exercise; chilling of the body; immobilization; the occurrence of an acute visceral lesion, such as myocardial infarction or appendicitis, with localized reflex spasm of the skeletal musculature; acute arterial closure in the extremities, as in popliteal thrombosis; rupture of an intervertebral disc with pressure on a nerve root, and acute emotional stress.

Chief, Department of Physical Medicine, The Swedish Hospital.

Read at the Thirty-Seventh Annual Session of the American Congress of Physical Medicine and Rehabilitation, Minneapolis, Sept. 3, 1959.

Conditions which predispose a patient to trigger point are: chronic muscular strain, produced by repetitive movements frequently performed over a long period; general fatigue; acute infectious illness, for example, infectious mononucleosis, acute hepatitis or an acute infection of the upper part of the respiratory tract (postinfectious myalgia); a chronic focus of infection; nutritional deficiency; a progressive lesion of the nervous system; nervous tension (muscle tension) (Campbell and Parsons[4]); one of the disorders associated with the menopause or male climacteric; hypometabolism with creatinuria; menstrual pain and tension; allergy (Gorrell[5]); any painful condition; abnormal healing and scar formation.

Table 1: Classification of Symptoms

System	Subjective	Objective
Sensory	Deep aching pain	Hyperalgesia
	Headache	
	Hypersensitivity	
	Hyposensitivity	
	Hyperalgesia	
	Paresthesia	
	Anesthesia	
	Heterotopic pain	
	Arthralgia	
	Menstrual pain	
Postural	Giddiness	Listing, impaired righting reflex
	Dizziness	Loss of position sense
Muscular	Weakness	Weakness
	Shortness of breath	Twitching and fasciculation of muscle bundles
	Spasm	Ataxia, incoordinated movements
	Difficulty in swallowing	Limitation of movement
Visual	Blurring of vision	Diplopia and ambiyopia
	Scotoma	Field loss
	Ptosis	Ptosis
	Light sensitivity	Lacrimation
		Pupillary dilatation
Auditory	Transitory deafness	Transitory deafness
	Tinnitus	
Gastrointestinal	Anorexia	Vomiting
	Nausea	
Cardiovascular	Palpitation	Alterations of pulse
	Reddening of conjunctiva	Vasodilatation or vasospasm
	Faintness	Pallor and cyanosis
	Swelling	Lowered skin temperature
		Edema
Genitourinary		Alterations of menses
Other autonomic		Sweating
		Pilomotor stimulation (goose flesh)
Psychic	Depression of mood	Irritability
	"Jitteriness" or nervous tension	Restlessness
	Poor concentration	
	Lapse of memory	

Pathophysiologic Considerations

Trigger point actually is a pathophysiologic condition of neurons of the spinal cord rather than an abnormality of anatomic structures. The trigger point, therefore, ceases to exist when it is removed for biopsy, and little can be learned from microscopic sections.

Abnormalities of neurophysiologic function (table 1) may be demonstrated by stimulation of a trigger point. Such abnormalities are not produced by similar stimulation of normal tissues. It is generally believed that the disorder of function lies mainly in the central nervous system and that the peripheral nervous system may play only a minor role after the initial onset of the syndrome. Usually, however, the trigger point remains hypersensitive, for a period which may be prolonged by abnormal function of the central nervous system.

Excessively intense impulses traveling through any neuron of the central nervous system will deposit energy faster than it can be "drained off" normally and will initiate the phenomenon of irradiation, or "spreading," of the impulse out of its accustomed channels and into adjacent, unnatural channels. This is analogous to a short circuit in an electrical system, and produces pathophysiologic sensations and reflex motor and autonomic responses, according to Kelly.[6]

Impulses which travel through unnatural channels can act to facilitate or inhibit normal activity, can abolish normal reflexes or initiate pathologic reflexes (Kelly[6]) and can interfere with the transmission of reflexes (myotactic, flexor, extensor and crossed reflexes) of long spinal pathways, ascending and descending and projection systems, the alpha fiber systems and the systems of postural control. Thus, pain arising in one area may be falsely interpreted by the cortex to be arising from an entirely different and sometimes remote area, as in heterotopic pain, on which Campbell and Parsons[4] have commented. Such irradiation, or splashing over, into the lateral horn will be responsible for varied autonomic "concomitants." Discharge into ascending projection systems and the alpha fiber systems can be responsible for disturbances of cortical function.

Excessively strong stimuli also can initiate a vicious circle of impulses in a network of neurons, so that one neuron activates a second, this a third and so on until the last one reactivates the first, and a trapped impulse runs around and around the neuron circle (Gerard[2]) (fig. 1). This activity can be

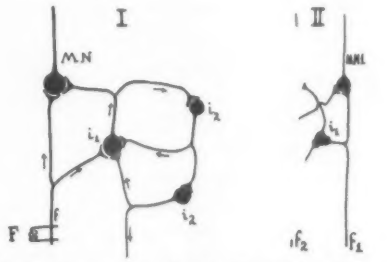


Fig. 1 — Diagram of a closed, self-reexciting chain of neurons: *F*, electrodes; i_1, i_2, neurons; *f*, fiber; *MN*, motor neuron (from Lorente de Nó, R.: Facilitation of Motoneurones, Am. J. Physiol. 113:505-523, 1935).

maintained by much weaker stimuli than the one that precipitated it, as a waterwheel can be kept turning by a small flow of water once it has been set in motion. Thus the flow of impulses in the "vicious circle" continues to feed impulses into unnatural channels and accounts for the persistence or easy reestablishment of the signs and symptoms associated with the trigger-point phenomenon. Undoubtedly it contributes to the reinforcement of the original trigger point.

An initially excessive afferent barrage of sensory impulses coming into the spinal cord can create an abnormal dynamic state of the neurons of the cord and start activity in a closed, self-reexciting chain of neurons in the internuncial system. Gerard[2] explained the persistence of such complaints in terms of the formation of a reverberating circuit, which could prolong the existence of an abnormal state (trigger point) for months and years (Gorrell[5]).

The referral of pain under such conditions is understandable. The cephalic representation of the deeper structures, being sparse, is dwarfed by the interconnections from sensory elements on the surfaces of the body. Typically, the patient will be aware of the referred pain or alterations of sensitivity of the skin and of the autonomic concomitants. Only occasionally will he be aware of the painful trigger point residing in the deep structures unless it is demonstrated to him. Therefore, the referral pattern of pain and sensory disturbance or its autonomic concomitants is in the scleratome, as Campbell and Parsons[4] observed, and not in the dermatome distribution of the same level (fig. 2).

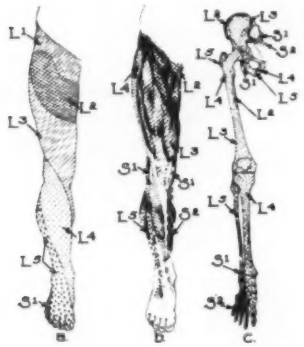


Fig. 2 — Diagrammatic representation of dermatomes and scleratomes: a, Dermatomes; b, segmental innervation of superficial musculature; c, segmental innervation of the skeleton (from Inman, V. T., and Saunders, J. B. DeC. M.: Referred Pain from Skeletal Structures, J. Nerv. & Ment. Dis. 99:660-667, 1944).

Clinical Manifestations

The subjective and objective complaints of the myofascial trigger syndrome are many and varied (table 1). The number and type of symptoms exhibited by any one patient depend on the location of the trigger point or points.

Objective symptoms may be observed by the examiner and measured with the appropriate instruments (electromyograph, myometer, skin thermometer or galvanometer). The accurate description of the referral of pain into the proper scleratome distribution could be done only by a patient actually experiencing heterotopic symptoms, and this may be accepted as objective proof of the existence of a trigger point.

Reactions to stimulation of the trigger point—such as grimacing, crying out and withdrawal from the stimulus—occur in a reflex manner with a rapidity and uniformity which could not be simulated by a malingerer.

Diagnosis

The diagnosis of the trigger point is confirmed by the location of a point of extreme tenderness to palpation below the skin, in the subcutaneous connective tissue, muscle, fascia, tendon or ligament. Such a point, on repeated stimulation by palpation, tetanizing current, stretching or needling, will reproduce one or more (frequently all) of the patient's complaints, and may even set off other characteristic symptoms which the patient had not until then experienced, according to Travell.[3] The referral of pain or other sensory or motor effect will occur in the distribution of the scleratome to which the point belongs.

The diagnostician must be wary of making a snap judgment concerning the existence of an anatomic rather than a physiologic disorder on the basis of the presenting symptoms. Likewise, he must be careful not to aggravate his patient's difficulty by concluding from the absence of anatomic abnormality that the symptoms are a form of hysteria or malingering. Kelly[6] commented:

"About the majority of these patients there is little that suggests the hysteric; but it is a melancholy fact that many of them do acquire this damaging stigma."

Treatment

Treatment of the trigger-point phenomenon, as Gerard[2] and Livingston[1] recommended, can be accomplished by:

A. Injection of procaine hydrochloride:

The elected site for blocking the pain afferents is the trigger point itself. The blocking of nerve trunks or roots or the use of a general anesthetic would prevent the subsequent stimulation of the input of the normal afferents.

Procaine hydrochloride 0.5 or 1.0 per cent (without epinephrine) or other solution must be injected into the immediate vicinity of the trigger point. A 24-gage 2½-inch (7.35-cm.) needle is inserted quickly through the skin without previous wheal formation and from 0.2 to 1.0 cc. of solution is injected into the trigger point. Location of the point is facilitated by squeezing the muscle between the fingers or against an underlying bone, repeatedly and from different angles, until the maximum pain response is obtained. An estimate of the depth and direction of the point may be ascertained also by "triangulation" from the varied approaches (fig. 3).

If the initial insertion of the needle does not produce a maximum response, then the needle may be partially withdrawn and reinserted at a slightly different angle until the proper point is located. Success in locating the point is enhanced at times by placing the muscle "on stretch," according to Travell.[3]

B. Stimulation of sensory input:

Routine physical and occupational therapeutic technics are particularly appropriate for producing stimulation of sensory input. Application of heat or cold, massage, muscle stimulation, exercise, stretching and coordinated movements will stimulate one or more sensory systems and initiate normal reflexes of the spinal cord. A persistent inflow of normal impulses caused by these means will help to free the "captured" neurons from the chain of neurons through which the abnormal impulse

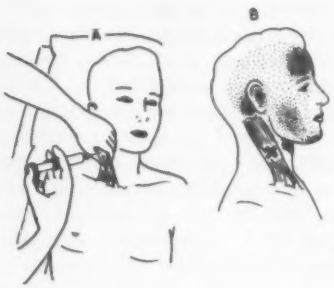


Fig. 3 — Head syndrome of sternomastoid muscle: *A*, Manner of holding muscle for local infiltration of procaine hydrochloride; *B*, Distribution of pain (stippled) from trigger area (*X*), induced either by compressing it between the fingers or by inserting needle as shown in *A* (from Travell.[3])

is circling. The deceleration of the abnormal self-regenerating circuit will help to reinstate normal patterns of activity.

Some forms of treatment used to liberate the captive neurons may produce rather intense afferent stimulation. The rhythmic application of cold by means of ethyl chloride spray is sometimes extremely effective in treating trigger points.

An alternate approach to treatment, also highly effective, is the introduction of means of decreasing afferent stimulation. Sometimes the maintenance of the vicious circle is dependent on steady stimulation from other areas of the central nervous system. Jacobson's[7] method of progressive relaxation can be an effective help by inducing muscle relaxation and decelerating synaptic response in the spinal cord. Other medication besides injection of procaine hydrochloride also can help to modify the reinforcement of the vicious circle by psychic stimuli.

Table 2: Analysis of Treatment

	Physical Therapy before injections	Number of injections	Physical Therapy after injections
Most sessions per patient	30	8	8
Least sessions per patient	1	1	0
Average	8.5	2.1	1.68
Mode	7	1	0

Clinical Evaluation

One hundred twenty-three (123) cases of myofascial pain lasting for days or years were analyzed after recovery (table 2).

Only cases in which other therapeutic methods failed to bring relief were selected for this series. Injections were made in the manner herein described. The results of the combined treatment were considered excellent in 90 cases (73 per cent), good in 21 cases (17 per cent) and poor in 12 cases (10 per cent).

References

1. Livingston, W. K.: Pain Mechanisms: A Physiologic Interpretation of Causalgia and Its Related States. New York, The Macmillan Company, 1943.
2. Gerard, R. W.: Physiology of Pain: Abnormal Neuron States in Causalgia and Related Phenomena. Anesthesiology 12:1-13 (Jan.) 1951.
3. Travell, J.: Referred Pain from Skeletal Muscle. New York J. Med. 55:331-340 (Feb. 1) 1955.
4. Campbell, D. G., and Parsons, C. M.: Referred Head Pain and Its Concomitants. J. Nerv. & Ment. Dis. 99:544-551 (May) 1944.
5. Gorrell, R. L.: Musculofascial Pain: Treatment by Local Injection of Analgesic Drugs. J.A.M.A., 142:557-561 (Feb. 25) 1950.
6. Kelly, M.: Interstitial Neuritis and Neural Theory of Fibrositis. Ann. Rheumat. Dis. 7: 89-96 (June) 1948.
7. Jacobson, Edmund: Progressive Relaxation: A Physiological and Clinical Investigation of Muscular States and Their Significance in Psychology and Medical Practice, ed. 2. Chicago, University of Chicago Press, 1938.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

VERY IMPORTANT

The next examinations, written and oral, of the American Board of Physical Medicine and Rehabilitation will be held in Chicago during the week of June 11, 1962, the exact dates to be announced later. The final date for submitting application is February 15, 1962. Write to the Secretary, Dr. Earl C. Elkins, 200 First Street, S. W., Rochester, Minnesota, for application.

Electromyographic Data in Idiopathic Scoliosis

Dr. Jacques Le Febvre
Dr. Alice Triboulet-Chassevant
and
Dr. M. F. Missirliu
Paris, France

● A series of 35 cases of idiopathic scoliosis and faulty posture was examined by serial electromyograms taken at various stages of development of the deformity. Skin electrodes were applied at four centimeter intervals on a double axis, three centimeters laterally from the spinal crest. Three areas were explored: the high dorsum, low dorsum and lumbar area. All cases of paralytic scoliosis and of scoliosis due to skeletal malformations were eliminated from the series. The remaining 35 cases of idiopathic scoliosis were subdivided into two main groups depending on the presence or absence of a tilt or imbalance of the pelvis. The groups were further subdivided on the basis of the number of curvatures present. An over-all predominance of the amplitude and intensity of the action potentials was observed on the convex side of the curvatures. This asymmetry of the action potentials appeared early in the course of the disease and was found to be a reliable sign for the recognition of active and progressive forms of scoliosis. Electromyographic evaluation also permits an appraisal of the efficacy of corrective maneuvers.

Asymmetrical action potentials of the paravertebral muscles in scoliotic patients were first reported in 1951 by Lerique and LeCoeur. Many authors have since tried to define these changes in greater detail by means of serial electromyograms.

The paravertebral muscles show evidence of more intense activity, reflected by the higher amplitude of their action potentials, on the convex side of the spinal curvatures of scoliotic patients. This asymmetry may be interpreted as being either a consequence of the skeletal anomaly, or as the primary cause accounting for the faulty posture and the subsequent curvature of the spine. We have attempted to study this problem by examining a series of 35 cases of idiopathic scoliosis and faulty posture by means of serial electromyograms taken at various stages of their development.

Technic

Skin electrodes were applied at four centimeter intervals on a double axis, three centimeters laterally from the spinous processes. Three areas were explored: the high dorsal, low dorsal and lumbar regions. In some cases the high dorsal electrodes were replaced with flank electrodes placed on the anterior axillary line. We were unable to suppress the electrocardiogram interference in these leads.

After several preliminary trials we adopted the following standard procedure, cutting examination time to a minimum.

A. Patient prone, chin supported, head in median position, arms extended and adducted. Tracings then are obtained in: (1) resting position, (2) lordotic position, and (3) position resulting in a correction of the postural abnormality.

B. Patient standing. Tracings are obtained in: (1) neutral position, (2) anterior flexion, and (3) after return to neutral position.

C. Patient standing. Tracings obtained after postural correction by orthopedic devices. Whenever possible the latter was recorded with the patient wearing his personal brace.

Lateral flexion had to be discarded because of the difficulty in obtaining a uniform range of motion in children, making comparison of the tracings unreliable.

Patient Material

All cases of paralytic scoliosis and of scoliosis due to skeletal malformations were eliminated from our series. The remaining 35 cases of idiopathic scoliosis were subdivided into two main groups depending on the presence or absence of a tilt or imbalance of the

Electroradiologist des Hôpitaux des Enfants Malades.
From Ancien Extenne des Hôpitaux de Paris.
From Hôpitaux des Enfants Malades.

Read at the 3rd International Congress of Physical Medicine, Session on Scoliosis, Washington, D. C., August 23, 1960.

pelvis. The groups were further subdivided on the basis of the number of curves (1, 2 or 3)) present.

The reversibility of the deformity was also taken into account. The greatest ease of correction was observed in cases of faulty posture or scoliotic attitude. Most of these patients undergoing treatment were followed by means of serial electromyograms.

Tracings

It must be emphasized that at present no satisfactory way of expressing numerically the intensity of electrical muscle activity is available. An arbitrary score was therefore devised in order to express the extent to which the activity predominated on one side as compared to the tracing obtained on the opposite side. Cases in which the highest predominance was observed rated a maximum score of "2." Other cases with less pronounced differences of activity rated scores of respectively "1.5" and "1." Barely perceptible differences were illustrated by the symbol #. This diagrammatic score was compared with the clinical data.

In the course of voluntary symmetrical movements, a time lag between the onset of the electrical activity surge on one side as compared to the opposite side usually was observed.

Discussion

An over-all predominance of the amplitude and intensity of the action potentials was observed on the convex side of the curvatures. This asymmetry of the action potentials appeared early in the course of the disease and was found to be a reliable sign for the recognition of active and progressive forms of scoliosis. Predominance of this asymmetrical activity in the lumbar or dorsal area establishes a significant topographic localization.

Electromyographic evaluation also permits an appraisal of the efficacy of corrective maneuvers, provided that the examination is repeated at regular intervals. One isolated electromyogram is of little value. Corrective maneuvers in a previously untreated patient are as a rule imperfectly executed by the patient who is hampered by the electrodes on his back and by the absence of practice. We have observed nonetheless in some instances a nearly complete control of the electrical asymmetry by means of standard exercises and maneuvers used in the gymnastic treatment of scoliosis, such as the Boltanski method or the M. Niederhoffer maneuver.

Serial recordings permit an accurate appraisal of the obtained correction; they also show whether the gymnastic treatment has been successful and may be replaced by ordinary symmetrical daily exercises.

Electromyographic tracings, obtained whenever the shape of the orthopedic supporting device permits the application of electrodes (such as the Rocher brace), are valuable for demonstrating the efficacy of the device. Good results are observed whenever the spine is accurately balanced and the paravertebral musculature is completely at rest. Results of traction and derotation casts also can be evaluated by comparing pre- and post-therapeutic tracings.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Use of Celastic for Temporary Bracing in Peripheral Nerve Injuries

Israel Muss, M.D.
and
Nancy Lamport, O.T.R.
Louisville, Ky.

● Use of Celastic for the fabrication of temporary bracing represents an effective method of treatment in physical medicine. Cases of peripheral nerve injury involving the radial, median, and ulnar nerve (alone or in combination) can be fitted with a celastic splint for proper positioning. Temporary splints can also be adapted to paretic extremities, including foot drop following paraplegia or peripheral nerve involvement. The celastic also adapts itself to the temporary fabrication of pylons in the upper extremity to which may be affixed tools for the retraining of function. The use of the temporary splint or brace in no way takes the place of regular bracing or splinting but merely acts as a stop-gap during the acute period. During the time the permanent brace is being fabricated, which in many instances requires several weeks, the Celastic splint prevents overstretching of a part or fibrosis and fixation of a joint.

Peripheral Nerve Injuries

Peripheral nerve injuries present a serious problem to the physical medicine department—not so much for the actual motor nerve and sensory involvement, which is the primary concern of the neurosurgeon, but for the inevitable trophic and joint changes, which reduce eventual functional return. These changes are usually manifested by characteristic deformities, either because of muscle imbalance from overpulling against the paretic muscle, or from secondary changes which take place from capsular contractures, fibrosis, and vascular trophic changes.

The phases following nerve injury fall into two stages: In the first phase, where there is expectation of recovery, the aim is to prevent overstretching of the paralyzed muscle, contracture of the antagonist, and joint stiffness by having the patient engage in activities to maintain functional capacity and prevent trick movements.

In the second phase, where further recovery is not anticipated, the functional advantage becomes important and substitution in a permanent fashion is the prime concern.

The indication in forearm and hand orthetics is to give support in alignment of the forearm, wrist, fingers, and thumb in functional position.[1] It should permit movement and, if necessary, should provide for adaptive functional equipment.

In radial nerve paralysis,[2] there is often marked cortical-sensory loss. The proprioceptive sense from the muscle tendon and joints is strange and imbalanced. Attempted movements are incoordinated and it is impossible to stabilize the wrist. If this state persists for a considerable length of time, the metacarpophalangeal joints become stiff, the ligaments contract, and the unopposed antagonists become shortened.

In a series of 60 median nerve injuries, none of which had been treated by splinting in the primary phase,[3] no instance of restoration of perfect opposition of the thumb was found. The thumb defect was attributed in a large percentage of cases to overstretching of the abductor pollicis brevis muscle. Although this muscle was adequately reinnervated, the thumb was incapable of producing abduction and medial rotation of the proximal phalanx.

Following nerve surgery repair, there is a physiological delay during which the ingrowing axons employ the grafted section as a lattice work upon which they grow.[4] The muscle tendon, acting as a guy wire to the bone as a lever arm, is unprotected until the final restitution of motor power. The extremity then has good nerve continuity, but is a poorly functioning part, because of irreversible trophic changes.

Splinting

Prolonged immobilization of a part with a splint may cause atrophy and

Chief, Physical Medicine and Rehabilitation Service, VA Hospital.
Physical Medicine and Rehabilitation Service, VA Hospital.

Read at the Thirty-sixth Annual Session of the American Congress of Physical Medicine and Rehabilitation, Philadelphia, August 28, 1958.

edema, and following edema, fibrous deposits are laid down with resulting contractures. The secondary effects may involve ligaments which become shortened and thickened, preventing free joint movement. Especially in a rheumatoid diathesis, prolonged splinting is prone to cause stiffness and shortening of the capsule and ligament. The sage remark, which has been attributed to Bunnel,[5] that "a hand, like a wild bird if kept caged up too long, soon forgets to fly," remains valid and pertinent.

Improper splinting, as is well known, may cause harmful results. If the retaining straps are too tight, local circulation may be cut off, and by nerve compression, cause subsequent irreversible damage.

Formerly splints were made in brace shops on order given to orthetists and prosthetists for fabrication. These agents, often busy because of shortage of trained personnel, were unable to expedite orders, resulting in long delays.

In the lower extremity, involvement of the common peroneal nerve usually means drop foot.[6] If this condition is unprotected, the tibialis anterior muscle and the extensor hallucis longus muscle are overstretched. Along with this, there are also sensory disturbances of the outer aspect of the leg and foot.

If the patient is confined to bed for a fracture of the pelvis or femur involving the sciatic nerve and common peroneal nerve, a long period of immobilization is necessary. There may be deleterious effects in the unprotected foot. Splinting here would aim at keeping the foot at right angles with the tibia to provide a proper balance. At the same time the pull should adequately prevent equinovarus deformity.

In the past, splints have been fabricated from malleable wire screen, sheet metal, galvanized iron, aluminum alloy, and Bessemer steel rods.[7] Occasionally, blue spring steel or clock spring have been used. Piano wire which had been oil tempered has also been used in fabrication. It is understandable that plaster of Paris, being cheap and almost universally obtainable, would be used widely to hold a joint immobilized. However, because of its very rigidity, it does not lend itself to functional splinting. Felt, sponge rubber, and leather in the form of straps and cuffs have been employed. These often deteriorate and, under excessive sweating, tend to absorb and hold odors. In hot, damp conditions, mildew or fungus overgrowth may render the latter materials objectionable.

Splints should not only maintain the position of function, but, in addition, should allow some movement. If traction is applied to the fingers, it should follow the anatomical curve of the joint. A splint should naturally allow voluntary movement (provided there is no contraindication) of all uninjured parts of an extremity. The thumb in median nerve involvement especially needs support.

Recently, plastic materials, formerly used in industry, have become more available and cheaper. Synthetic materials, as a group, are usually malleable and thermoplastic. However, they often have the fault of being inflammable and occasionally cause contact dermatitis. Materials such as vinylite, celluloid, or castex may be molded over curved or bony areas, and by coating with either fabric, stockinette, or moleskin are usually rendered nonallergenic.

Celastic

Celastic is the trade name of napped cotton flannel impregnated with pyroxylin and is fire-resistant and plastic in the precipitated state.[8] When the sheet is dipped in ethyl acetate as a solvent, it becomes pliable and can be molded or reshaped for about 10 minutes, after which it dries rather rapidly and becomes rigid. It can be smoothed by sanding or steel wool. It can be painted and lends itself to drilling for the application of grommets, fasteners, snaps, belts, and buckles. Celastic is extremely light in weight and easy for the therapist to fit since it can be shaped. It withstands strain, is low in cost, and has enough give to permit

protection of the first dorsal space interosseus muscle, as well as stabilizing the metacarpal bone.

Certain precautions must be observed in using Celastic.[9] Work should be done in a well-ventilated room; fire precautions should be strictly observed; the hands should be protected with rubber gloves when working with the solvent. The patient's skin should be either covered with oil silk or a light glove material. Care should be observed for wood finishes, since the solvent has etching qualities.

Recently the occupational therapy departments in many hospitals have been assigned the job of temporary splinting in peripheral nerve injuries. Frequently they received the hearty cooperation and technical advice of qualified orthetists since this relieved them of a burdensome task. The occupational therapist is in the position of seeing the injured hand or foot at an early stage and is able to follow the progress made with the extremity through long phases of rehabilitation.

After going through the literature describing the technic of using Celastic, we have, by means of trial and error, devised a simple technic for using it as a temporary splint.[8,10,11] In forming the temporary Celastic splint, a combination of measurements of the part to be splinted, a paper pattern drawn to show the approximate area to be splinted, and Yankee ingenuity are used.

Tools needed are:

1 pair of leather scissors
1 pair of small scissors
1 X-Acto knife with double-edge blade
1 small hammer
1 snap set

Materials needed are:

#125 Celastic
Celastic solvent
Brace buckles (1" and ¾")
Webbed tape for straps (1" and ¾")
Handi-rivets
Moleskin for lining
Foam rubber

Reinforcement materials (lightweight aluminum sheet, coathanger wire, and plexiglass of assorted thicknesses)

Procedure

After the pattern is made,[7,9-11] the Celastic is cut to specification. If it is known that the splint must be reinforced, it is necessary to cut the Celastic so that the rough, numbered side is away from the patient's skin. One side of Celastic is relatively smooth when wet. The other side becomes rough and fibrous to aid in laminating either on itself or to another material.

After the splint is cut out, it is immersed in the Celastic solvent for 15 to 30 seconds. Upon its removal from the solvent, it must be air-dried until the Celastic can be molded without immediately going back to its original shape. This "drying" takes about 7 to 10 minutes.

When this initial "drying out" is complete, the splint may be applied to the patient for further shaping, first the part being protected, although we have not found any contact dermatitis. If the splint is to go above the wrist joint, for either wrist stabilization or cock-up, we have found that an elastic bandage or inner tubing can be very helpful. We wind the bandage around the forearm area to secure and mold that part of the splint, leaving the therapist free to manipulate the more intricate areas of the hand.

The splint is held in place for approximately 10 minutes. After it has turned light gray in color and retains its own shape, it may be carefully removed from the patient. Great care must be taken when it is removed so its shape is not altered. Only by experience can the feel of molding Celastic be learned. However, we have found it a good practice to let the splint dry from 5 to 10 minutes and then return it to position to see that no further changes must be made. At this time, it is still possible to make minor changes.

When the Celastic is first dipped in the solvent, it becomes cold. As the chemical reaction of polymerization, necessary for the hardening process, takes place, the splint may feel warm and sometimes prickly to the patient's

skin. This reaction may not be noticed by some patients. Some may mention mild discomfort.

When the splint has thoroughly dried (about 3 hours), it is necessary to consider and reinforce the points of stress. If the splint is to be worn only at night, probably the only need for reinforcement will be an additional strip of Celastic laminated on the under surface of the splint. This strip should extend from the metacarpophalangeal joints to a point approximately 6 inches above the wrist joint.

If the splint is to cross the dorsal area of the forearm and hand, it must be more securely reinforced by laminating a layer of plexiglass, stout wire, or aluminum between the layers of Celastic. Here, great care must be taken that the "internal core" be cut narrower. The outside lips of the Celastic above and below are laminated together. Actually the reinforcement is sandwiched in Celastic planes.

After the splint has been properly reinforced, it must be trimmed to exact size. This is done most conveniently with either an X-Acto knife or leather shears. It is necessary to "finish" the cut edges with a piece of cotton dipped in the solvent so that there will be no possibility of abrading the skin. At this time, the fastenings and straps are applied with Handi-rivets. Next, the moleskin lining is cut from the original pattern and then applied to the splint. It is trimmed just to the edge of the inside of the splint, or brought around the outer rim to the top surface.

Pressure points may be relieved by remoistening with solvent and reshaping it, or, if space permits, a bit of foam rubber or felt may be applied.

Should the patient's condition require a change in his splinting, it is possible to laminate further pieces of Celastic to the existing brace. Areas may be carved away. The positioning may be changed by moistening the material in the solvent and remolding it to suit the new requirements. This process is inexpensive enough so that when the patient has no further need for temporary bracing, the buckles may be removed and saved, and the rest discarded.

Conclusion

In the past two years, we have used Celastic as a temporary splinting in a variety of peripheral nerve injuries: median, radial, ulnar, and peroneal paralysis. We stress the fact that this splinting is merely a temporary measure and in no way a substitute for a permanent orthetic device. Frequently, an alteration of the points of stress is necessary. These functional splints have permitted the patient to use the remaining movement in a correct pattern. We feel that Celastic is an excellent material for fabrication of temporary splinting in peripheral nerve injuries.

References

1. Napier, J. R.: Use of Splints in Peripheral Nerve Injuries. Brit. J. Phys. Med. 14:281 (Dec.) 1951.
2. Palmer, K. W. N.: Active Splinting for Radial-Nerve Palsy. Lancet 1:906 (May 13) 1950.
3. Brock, S.: Basis of Clinical Neurology, ed. 2, Baltimore, Williams & Wilkins Company, 1945, p. 15.
4. Bunnel, S.: Surgery of Hand, ed. 2, Philadelphia, J. B. Lippincott Company, 1948.
5. McDonald, J. J., and Chusid, J. G.: Correlative Neuroanatomy and Functional Neurology, ed. 8, Los Altos, Calif., Lange Medical Publications, 1956.
6. American Academy of Orthopaedic Surgeons, Inc., vol. 1, Orthopedic Appliance Atlas, Ann Arbor, Mich., 1952, p. 277.
7. Shalik, H.: Versatile (Celastic) Pollex Device for Use in Occupational Therapy. Am. J. Occup. Therapy 8:208 (Sept.-Oct.) 1954.
8. Schulz, B.: Celastic Splints. Phys. Therapy Rev. 29:543 (Dec.) 1949.
9. Herschell, W., and Scales, J. T.: Plastic Splints and Appliances in Orthopaedic Surgery. J. Bone & Joint Surg. 30-B:298 (May) 1948.
10. Brennan, J. B.: Plastic Appliances Moulded Direct to Patient. Lancet 1:841 (April 23) 1955.
11. von Werssowetz, O. F.; Witt, R. N., and Elliott, R.: Functional Wrist Splint, J. Bone & Joint Surg. 38-A:224 (Jan.) 1956.
12. Bennett, R. L.: Orthetics for Function, read before the American Physical Therapy Association, New York, June 22, 1956.

Vocational Rehabilitation of the Quadriplegic

Robert A. Walker, M.A.
Minneapolis

● This paper discusses the general contribution of a rehabilitation program in the attainment of employment goals for the quadriplegic patient. For this discussion quadriplegia is defined as an injury, rather than a disease process, to the cervical cord. The adjustment mechanism of quadriplegics as well as the attempt to help them develop attitudes which facilitate rehabilitation are discussed. Although the number of vocational goals are limited there still are a substantial number of employment objectives for quadriplegics. They find their best outlet in occupations in the professional, technical, managerial, clerical, and sales areas. The limited information available on quadriplegics indicates that the bulk of them are employed at home but factors concerning employment possibilities outside the home and the part the vocational counselor plays in reaching decisions on whether the quadriplegic can work outside the home are considered in this study. Other responsibilities of the counselor and the role of all team members concerned with the quadriplegic also are discussed.

Approximately 4000 years ago an unknown author[1] commented briefly on cervical cord injuries: "One having a crushed vertebra of his neck; he is unconscious of his two arms and legs, and is speechless. An ailment not to be treated." In reviewing the limited number of articles concerning the outlook for vocational rehabilitation of quadriplegics, one is entertained with the thought that the unknown writer may have been a vocational counselor. At best, the number of employed quadriplegics appears to be a modest one. Although several articles indicate that some quadriplegics are employed, only two state actual figures. Bors[2] relates that the employment figures of quadriplegics are low and quotes a survey indicating that eight per cent had "gainful employment." Frost's[3] study comparing employment figures of quadriplegics and paraplegics indicates that somewhat over 51 per cent of his paraplegic group was employed while 28 per cent of the quadriplegics were employed. This latter study is difficult to assess since a major variable, the degree of physical capacity, is reported in percentage of involvement with no clear indications as to what the various percentages mean. In contrast, there are a number of articles which clearly indicate a higher success ratio in the employment of the paraplegic. Guttmann,[4] for example, quotes an employment rate of 69 per cent and hints that this may be a minimal figure. In general, the surveys seem to indicate that a minor proportion of quadriplegics ever become employed and that the employment figure of eight per cent quoted by Bors is perhaps the best current estimate.

The purpose of this paper is to discuss the general contribution of a rehabilitation program in the attainment of employment goals for the quadriplegic patient. In doing so, it hopefully will stimulate the development of rehabilitation programs for the quadriplegic which will include goals other than those which are primarily physical. For the purpose of this paper, quadriplegia is defined as an injury, rather than a disease process, to the cervical cord. These patients have motor involvement in the upper as well as the lower extremities. Although some function may be present below the level of their anatomic lesions, these patients are not ambulatory. Furthermore, they have bowel, bladder and sensory difficulties comparable to those patients with a completely severed cervical cord.

Problem and Discussion

Along with its success in extending the life expectancy of the quadriplegic, the medical profession has created an entirely new series of problems which currently are being encountered in rehabilitation. These problems involve consideration of the patient's social, psychologic and vocational needs as well as those which are medical. The first difficulty to be encountered in dealing with these problems is simply the lack of information. This can be noted by comparing the number of articles on the medical aspects of spinal cord injuries as contrasted to those of paramedical services. In a bibliography[5] on paraplegia compiled in 1956 by the Department of Medicine and Surgery of the Veterans Administration,

Rehabilitation Coordinator, Minneapolis Rehabilitation Center.

there were a total of 726 articles on the medical aspects while only 43 articles applied to the patient's psychologic, vocational and social needs. Apart from the lack of information perhaps what is more distressing is the current lack of agreement regarding the value of contributions from paramedical personnel to the rehabilitation of the quadriplegic. Covalt,[6] for example, discusses the typical paraplegic's program and allocates only one hour of the day for vocational counseling, social and psychologic services. Munro[7] in an article stressing the role of the physician feels that for the most part, psychologic technics have little to offer. In speaking of the need for a psychiatrist, he comments that "It was therefore neither practical nor useful to call in psychiatric consultations in any case." Wittkower[8] et al., while offering several reasons for the use of psychologic technics in the rehabilitation of the paraplegic, is not nearly as optimistic regarding the marriage of psychology and quadriplegia. However, these statements do not necessarily represent the reflections of all authors in the field. In an article by Thom[9] in 1946 based on a survey of 109 paraplegic males, he comments that "the obligation of the physician to the patient goes beyond specialized medical care." At the end of this article he states when speaking of the patient: "He needs someone with whom he can talk over his problems and on occasion he requires the assistance of a trained psychiatrist." In a more recent article involving the rehabilitation of quadriplegics, Kent[10] states: "Assistance from the psychiatrist was essential." A number of other authors including Mueller,[11] Nagler,[12] Dawson,[13] Sverdlik[14] and Seymour[15] also have commented favorably on the contribution of psychology to the rehabilitation of patients with spinal cord injuries. However, apart from a general disagreement involving whether psychology has anything to contribute, there appears to be equally less agreement involving just what the contribution might be. Grayson,[16] for example, while feeling that acceptance of the disability is the key to successful rehabilitation, states that psychology is useful both for understanding the patient and for psychotherapeutic purposes. Thom[9] suggests that weekend visits home facilitate rehabilitation. Sverdlik[14] feels that activity is essential in the rehabilitation of a quadriplegic. Wittkower[8] offers the suggestion that the psychiatrist can help plan the program and states that group therapy and homogeneity in the ward can facilitate rehabilitation. Alger and Rusk[17] discuss the value of the psychiatric approach but offer little in terms of methods. Before we can begin to develop more adequate rehabilitation technics, we must first recognize that the quadriplegic is more than just a medical and nursing problem and that these patients do have rehabilitation goals which involve contributions by the field of psychology. One might observe, at this point, that if medicine has not fully accepted psychology, it may well be due to the lack of technics which psychology has offered medicine. Perhaps what is needed is a critical analysis of current rehabilitation programs which will suggest psychologic contributions for determining and facilitating more extensive rehabilitation goals.

The Rehabilitation Program

It is unfortunate that in addition to the paralysis the typical quadriplegic admitted to a rehabilitation service often arrives with decubitus ulcers and attitudes hardly conducive to rehabilitation. Seymour[15] in discussing the adjustment mechanism of quadriplegics uses terms such as "quiet", "dreamy", and "compliant". To some personnel this might be looked upon as model behavior since in the tight scheduling of rehabilitation programs such patients demand little and are pushed sheeplike from one service to another. These patients typically function well in a medical program and it is only later that problems appear. As the patient progresses to the more personally demanding services, such as vocational rehabilitation, the necessary transition from passive to active participation presents an obstacle. The vocational

counselor finds that apart from his physical problems the patient seems to be unable to even consider the idea of employment. His "quiet", "dreamy" and "compliant" attitudes make for a pleasant interview but one without content, for the patient has already selected dependency as his career. What appears to be crucial is that during this early phase of the patient's program he must become personally involved in his own rehabilitation. Such patients must be helped to develop a sense of responsibility for their own life and they must recognize that their existence and accomplishments are dependent upon their involvement and participation in their own program. If the patient is to maintain or to increase his functional skills, the task of rehabilitation is to create a climate for growth of his inner resources since extrinsic motivators represented by staff personnel are usually not available after discharge. Those familiar with follow-up studies[18] or routine return appointments with the severely disabled recognize how patients so frequently fail to maintain their performance after discharge. It appears that the goals of rehabilitation must be more than medical and that one of the emphases should be a greater concern with developing attitudes which facilitate rehabilitation.

These attitudes can begin to shape early in the program. One of the first relationships formed by the quadriplegic is with the nursing service. It may be that the quality of this relationship is crucial to the rehabilitation goals of the quadriplegic. Mueller[11] recognizes the importance of the nursing phase by stating that "here is laid the groundwork for the psychologic rehabilitation of the patient." However, he fails to develop the issue into any technics which might be implemented on the nursing service. Literature on nursing care for the most part fails to state this issue clearly. One author[19] writes that "the care of the patient's skin is a matter of primary nursing importance." Actually, the matter of the patient's skin should be of more concern to the patient than it is to the nurse. The nurse should be less concerned with the patient's skin and more interested in developing within the patient a sense of responsibility for his own care. To further develop this concept the nurse might adopt the attitude that it is the patient who should request to be turned, to be inspected for decubiti and to see that he is not handled carelessly. In dealing with medications there appears much to be gained by having the patient request the periodic administration of routine medications rather than the nurse arriving at designated intervals with the drugs. The advantages in developing such attitudes are important not only for his future attitudes toward other rehabilitation goals, but may well insure better care after discharge when the quality of nursing care often diminishes. The occupational therapist also might assume this attitude by such methods as repressing his all too familiar cleverness with splints and aids and involving the patient in some problem-solving behavior. It appears that much is to be gained by suggesting to the patient that developing these devices is his responsibility, since any functional gain is that of the patient and not that of the therapist. The physical therapist working in the activities of daily living program might allow the patient to experiment with ideas involving transfers, setting up resistance exercises and wheelchair activities. While the patient is not as competent as the trained therapist, the gains in attitudes from his participation in his own problem may compensate for his lack of technical skills. The physician is perhaps in the most crucial position, since it is he who usually sets the tone of the treatment program and must weigh the advantages of patient participation along with the hazards of departure from more typical medical practices. In personal contact with the patient, he must allow the patient to make decisions in planning his program and to tolerate the errors which may occur. Learning by one's mistakes can be an expensive lesson but one which is often retained. In a sense one must use

the technic of indirection and must develop in the program subtle management principles where independence is accomplished by not allowing the patient to become dependent on the staff.

Vocational Aspects

A comment frequently made by rehabilitation personnel is that vocational rehabilitation has little to offer since there is really nothing that these patients are able to do. While it is true that the number of vocational goals is limited, there are still a substantial number of employment objectives for quadriplegics. A report prepared by the Department of Veterans Benefits[21] indicates that quadriplegics are employed in almost every major occupational category. However, for the most part, quadriplegics find their best outlet in occupations in the professional, technical, managerial, clerical, and sales areas. From this, one might infer that vocational rehabilitation will be more profitable with the brighter and more educated patient. The limited information available on quadriplegics indicates that the bulk of them are employed at home. However, these vocational objectives are often unsatisfactory for several reasons. First of all, this type of employment is not easily available and many of them require considerable physical skills as well as a great deal of perseverance and ingenuity. They also are rather unrewarding financially and, as in most new business enterprises, the mortality rate is quite high. The difficulties are many and the rewards are few, but until it is possible to program patients toward more demanding vocational goals, it is likely that the bulk of the quadriplegic patients will work at home.

The task of the vocational counselor becomes somewhat easier if one basic decision can be reached early. This decision involves whether or not the quadriplegic is able to work outside the home. This is a practical matter which can often be decided on physical issues. In order to work outside the home during an average work day, most employers must have a firm guarantee that the patient will not have bowel and bladder "accidents," and that any elimination problems such as emptying a urinal bag will not be the responsibility of the employer. The problems of sitting tolerance are even more imposing when one considers that a sitting tolerance of eight or nine hours might be demanded. A recent article[20] clearly indicates the sensitivity of tissue to ischemia and the necessity of frequent relief. If the patient cannot tolerate sitting even with foam rubber and alternating pressure seats for a minimum of four hours it is unlikely that employment outside the home will be possible. Patients with chronic urinary tract or upper respiratory infections and conditions such as thrombophlebitis may find it difficult to maintain steady employment ouside the home because of excessive absenteeism. Normally, an absenteeism rate of over 15 days a year can be considered excessive. Transportation to and from work is a lesser problem but it is still necessary to verify whether or not it will be consistently available. Apart from these rather permanent demands, the quadriplegic will usually have to be moderately proficient at manipulating objects (i.e., pens, telephone, books, paper), his wheelchair, and to be able to eat his noon meal with minimal assistance.

Positive indications for employment outside the home may exist in the patient's previous employment history. Hopefully, the patient was employed at the time of the accident and the employer will be willing to rehire him. It is likely that the job will need considerable modification, but it does appear that employment outside the home is greatly facilitated by previous work experience.[21] There are other factors which influence vocational rehabilitation and can contribute to employment either in or outside the home. Community resources are still another consideration which might positively contribute to vocational rehabilitation. Within this area it is the amount and

types of available industry that is probably the most important. The counselor will often be at a disadvantage when the patient comes from a small rural community. Not only is there less industry but often the jobs that are available will require a wide span of physical demands because of the lack of specialization which often exists in small industries. A factor sometimes balancing this is that the patient is often well known in the community and employers may therefore be more willing to modify job requirements. A well established industry in a small town can be highly sensitive to public opinion and therefore become more involved in a job modification program than its counterpart in a large community. It is interesting to note that in the vocational histories of many severely disabled patients there is often a resource person independent of the family or professional workers whose contributions are essential in vocational rehabilitation. Such people are often found in educational institutions or business organizations and although they often lack the analytic and studied approach of the professional, their enthusiasm and resourcefulness are a refreshing supplement to the rehabilitation team.

Another essential resource which the counselor must utilize is the family, since the quadriplegic will always remain dependent in many ways upon those around him. The patient will need the family for both physical and psychologic reasons. If the patient is to work at home, the employment objective will often become a family project.

Similar to the relationship between physicians and drugs is the fixation that vocational counselors have toward training. This modern day fetish is not the panacea it is claimed to be, and the counselor must proceed with caution. From an affirmative standpoint it can provide the counselor with a more saleable product and allow the patient to gain in self-confidence by the reward of academic accomplishments. From the negative viewpoint the counselor can become so enamored with training because of his desire to do something that he carelessly appraises the ultimate employment objective. The end result is then not just an unemployed quadriplegic but a well-trained unemployed quadriplegic. Although it is generally not a defensible position it appears that with the quadriplegic groups there must be a high degree of promise from some source that the training will result in employment. Also, because of the technical skills and personal attention required in placement the vocational counselor would do well not to place too much reliance on the training agency or Employment Service for assistance.

The basic resource of the counselor will of course be counseling at a consistently high skill level. Vocational rehabilitation of the quadriplegic requires more than a brief interview and the all too familiar phrase that "this patient is not interested in employment". This cherished shibboleth of noneligibility demonstrates a lack of understanding of patient behavior and counselor responsibility. One of the roles of the counselor is to change attitudes which limit patient performance. As mentioned previously this is also the role of all team members if vocational rehabilitation is to be successful.

Quadriplegia probably represents the most difficult problem in rehabilitation today. It is a problem which requires every member of the rehabilitation team to make a maximum effort if the patient's achievements are to involve goals such as vocational rehabilitation. In reality, the inabilities of patients to achieve appropriate goals do not represent failures by the patient, but by rehabilitation personnel who have not developed technics and programs which tap patient resources. Patient failures cannot be justified on the basis of rationalizations that such severely disabled patients cannot work. The few patients who have entered employment indicate that vocational goals are possible for some quadriplegics. However, until we are able to improve the quality of programs in the psychologic, social

and vocational areas as well as medical, the percentage of quadriplegics who become employed will continue to remain low.

References

1. Breasted, J. T.: The Edwin Smith Surgical Papyrus, Chicago, Illinois, University of Chicago Press, 1930, p. 339.
2. Bors, E.: Challenge of Quadriplegia. Bull. Los Angeles Neurol. Soc. 21:105 (Sept.) 1956.
3. Frost, R.; Frost, Alma, and Karpp, M.: Success or Failure in Economic Rehabilitation of Paraplegics and Quadriplegics: A Survey. Sponsored jointly by the Paralyzed Veterans of America and The 52 Association of New York, Inc.
4. Guttmann, L.: Statistical Survey on One Thousand Paraplegics and Initial Treatment of Traumatic Paraplegia. Proc. Roy. Soc. Med. 47:1099 (Dec.) 1954.
5. Department of Medicine and Surgery, Veterans Administration: Traumatic Paraplegia: A selected Bibliography, Compiled by Muriel McKenna, Reference Librarian. Washington D. C. (Mar.) 1957.
6. Covalt, D. A.; Cooper, I. S.; Hoen, T. I., and Rusk, H. A.: Early Management of Patients With Spinal Cord Injury. J. A. M. A. 151:89 (Jan. 10) 1953.
7. Munro, D.: Rehabilitation of Patients Totally Paralyzed Below Waist with Special Reference to Making Them Ambulatory and Capable of Earning Their Own Living: V. An End Result Study of 445 Cases. New England J. Med. 250:4 (Jan. 7) 1954.
8. Wittkower, E. D., and others: Combined Psychosocial Study of Spinal Cord Lesions. Canad. M. A. J. 71:109 (Aug.) 1954.
9. Thom, D. A.; Von Salzen, C. F., and Fromme, A: Psychologic Aspects of Paraplegic Patient. M. Clin. North America 30:473 (Mar.) 1946.
10. Kent, H.: Potential for Rehabilitation in Quadriplegic Teen-Agers. J. A. M. A. 169:817 (Feb. 21) 1959.
11. Mueller, A. D., and Thompson, C. E.: Psychological Aspects of Problems in Spinal Cord Injuries. Occup. Therapy 29:86 (April) 1950.
12. Nagler, B.: Psychiatric Aspects of Cord Injury. Am. J. Psychiat. 107:29 (July) 1950.
13. Dawson, A. R.: Emotional Aspects of Medical Rehabilitation. South. M. J. 46: 53 (Jan.) 1953.
14. Sverdlik, S. S., and Rusk, H. A.: Rehabilitation of Quadriplegic Patient. J. A. M. A. 142:321 (Feb. 4) 1950.
15. Seymour, C. T.: Personality and Paralysis. I. Comparative Adjustment of Paraplegics and Quadriplegics. Arch. Phys. Med. 36: 691 (Nov.) 1955.
16. Grayson, M.: Concept of "Acceptance" in Physical Rehabilitation. Mil. Surgeon 107: 221 (Sept.) 1950.
17. Alger, J., and Rusk, H.: Rejection of Help by Some Disabled People. J. Rehab. (Sept.-Oct.) 1955.
18. McCoy, G. F., and Rusk, H. A.: An Evaluation of Rehabilitation. Rehabilitation Monograph I. The Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, 1953.
19. Martin, J., and Craig, Iris: Early Care of Patients With Injury of the Spinal Cord. Am. J. Nursing 55:936 (Aug.) 1955.
20. Kosiak, M.: Etiology and Pathology of Ischemic Ulcers. Arch. Phys. Med. 40:62 (Feb.) 1959.
21. U. S. Veterans Administration: Occupation of Paraplegic Veterans of World War II and Korea, Washington D. C., Government Printing Office, (June) 1957.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

survey of selected literature

This systematic abstracting and indexing of selected journals is made possible by a grant from The American Rehabilitation Foundation, a subsidiary of the Kenny Rehabilitation Institute.

ACTA PHYSIOLOGICA SCANDINAVICA. *Vol. 51 (Part 2-3), 1961.*

◇ **Effects of Motor Inactivation on the Chemical Sensitivity of Skeletal Muscle. T. R. Johns, and S. Thesleff. pp. 136-141.**

The present study to investigate whether the lack of motor nerve impulses alters the chemically sensitive area in skeletal muscle, consisted of determining the size of the acetylcholine sensitive areas in muscle fibers of the tenuissimus muscles of the cat. Such determinations were made before, and at varying periods after, the elimination of all afferent impulses playing upon the lower motor neurones was accomplished by severance of the dorsal roots below a cord transection.

The sensitivity of the individual muscle fiber to acetylcholine was determined by iontophoretic micro-application of the drug, and by intracellular recording of the potential change. The frequency of miniature end-plate potentials, their amplitude, and their time course, were relatively unaffected by the isolation procedure. The procedure also caused little increase in the size of the acetylcholine-sensitive surface. Therefore, inactivation alone did not alter the chemically sensitive area.

◇ **Distribution and Concentration of Adrenaline and Noradrenaline in the Adrenal Medulla of the Rat Following Depletion Induced by Muscular Work. O. Eranko, and M. Harkonen. pp. 247-253.**

The rats were allowed to run for 16 hours, to rest for 12 hours, and to run again for 10 hours. They were killed immediately, three, six, 12 or 19 days thereafter. Concentrations of adrenaline and noradrenaline in the medulla were measured chemically. The intensities of the chromaffin reaction, the iodate reaction and formalin-induced fluorescence in adrenal sections were quantitated by microphotometry. Running caused an almost complete loss of both catecholamines from the adrenal medulla and the histochemical reactions turned almost negative. The catecholamine concentrations and the histochemical reactions returned to normal in six days. During the recovery phase the behavior of the noradrenaline-storing medullary cells differed histochemically from that of the adrenaline-storing cells.

Influence of noradrenaline on spinal interneuron activity. *Skoglund, C. R. p. 142.*

Electromyographic findings in experimental botulinum intoxication. *Josefsson, J.-O., and S. Thesleff. p. 163.*

Distribution and concentration of adrenaline and noradrenaline in the adrenal medulla of the rat following reserpine-induced depletion. *Eranko, O., and V. Hopsu. p. 239.*

AMERICAN JOURNAL OF THE MEDICAL SCIENCES. *Vol. 241, Jan. 1961.*

◇ **Circulatory Effects of Pipe and Cigar Smoking. D. L. Simon, and A. Iglauer. pp. 22-30.**

The recent literature has provided statistical evidence that the death rate in regular pipe and cigar smokers does not exceed that of non-smokers. This study reported here is to discover some of the circulatory effects of pipe and cigar smoking. Twenty five habitual male smokers were tested. The test consisted in smoking for 20 minutes at the habitual rate, but without inhaling. Changes in skin temperatures, blood pressure, pulse rate and the ballisto-cardiogram were observed. The effect of smoking low nicotine tobacco was compared with that of tobacco high in nicotine. Significant decreases were noted (average −2 C.) in finger skin temperatures, while toe and forehead temperatures showed no consistent change.

During smoking, increases in pulse rate, and systolic and diastolic pressures averaged about +10, +6, and +11 per cent respectively. Considerable individual variation was noted in the response in all parameters. In some subjects there were significant changes in the ballistocardiograms. On the average greater responses were noted in the BCG than are reported in the literature following cigarette smoking. Pipe and cigar smoking yielded essentially the same effects. Smaller changes were noted after smoking low nicotine tobacco.

◇ **Urinary Abnormalities from Over-Use of Muscles. J. H. Arnett, and K. D. Gardner. pp. 55-58.**

This is a case report with some discussion of the effect of strenuous-prolonged exercises in a young adult male who was subjected to severe fraternity hazing. Approximately 12 hours after the cessation of prolonged exercise he noted that his urine, though normal in volume, was brown in color. Twelve hours later he reported to a physician and presented a specimen of urine for examination. The brown, cloudy urine contained a dark brown sediment of granular casts, leukocytes and occult blood. Subsequent urine contained progressively less protein and less hemoglobin. Erythrocytes were never observed in urine specimens. Serum creatinine measured initially and two weeks following the onset was normal in both instances.
The authors point out that significant changes of the type reported above have frequently been noted to follow strenuous courses of knee bending exercise. They suggest that this maneuver might be a useful experimental procedure to use in studying physiological changes accompanying muscle conditioning and acute glomerulonephritis.

Routine urine cultures in private practice. *Windom, R. E.; R. K. Bass; R. F. McBride, and J. P. Sanford. p. 14.*

A controlled study of codeine, dextro propoxyphene and R O 4-1778/1. *Sadove, M. S.; M. J. Schiffrin, and S. M. Ali. p. 103.*

✶

AMERICAN JOURNAL OF THE MEDICAL SCIENCES. *Vol. 241, Feb. 1961.*

◇ **In Vitro Activity of Various Penicillins. C. G. McCarthy; G. Wallmark, and M. Finland. pp. 143-159.**

The import of this paper lies in the authors' conclusion that the therapeutic potential of a new penicillin (or other antibiotic) must be judged on the basis of its antibacterial activity as well as its absorption, toxicity and other properties as compared with these characteristics of currently available drugs. The *in vitro* activity of eight penicillins was tested against 550 strains of 20 species or genera of bacteria. The different penicillins were found to have widely differing minimum inhibiting concentrations against different species and genera and even to the various strains of the same species. A finding of particular interest was the marked difference in activity of the D- and L- isomers of phenoxyethyl penicillin. The L form was much more active against streptococci, while the D form was more active against Neisseria. The results of this investigation stress the importance of judging the merit of a new drug on the basis of its acceptability from all standpoints.

◇ **A Study of Migraine Pharmacotherapy. A. M. Ostfeld. pp. 192-198.**

This paper is of interest for two reasons. First, it presents a valid comparison of the effectiveness of antimigraine drugs separately and in combination. Secondly, it clearly demonstrates the usefulness of modern statistical methods in studying a problem of this kind. Previous investigations of the problem addressed in this paper have yielded equivocal results. Ergotamine tartrate has long been considered of value in treating migraine headaches. The importance of suggestion and placebo administration has previously been emphasized. Various drugs have been used in combination with ergotamine to relieve the nausea and vomiting accompanying administration of this drug.
Here, answers to two questions were sought: (1) The relative effectiveness of ergotamine tartrate and placebo given by mouth, and (2) the effectiveness of caffeine and cyclizine compared with that of belladonna alkaloids in reducing the incidence of vomiting accompanying ergotamine therapy. A total of 64 patients having a history of recurrent migraine attacks were studied. Comparisons of drug preparations and placebos were investigated by a double blind technic using a sequential analysis design. The antivomiting capabilities of the test drugs were compared using a modification of the chi square test.
The results indicated: (1) that orally administered ergotamine tartrate in a single 5 mg. dose was significantly more effective than the placebo in relieving migraine headache; (2) a single

dose of one drug preparation incorporating ergotamine, caffeine and cyclizine caused no more vomiting than placebo, and (3) admixture to ergotamine of belladonna alkaloids, caffeine and acetophenetidin induced more vomiting than admixture of caffeine and cyclizine.

Cerebral hemodynamics of syncope. *McHenry, L. C.; J. F. Fazekas, and J. F. Sullivan. p. 1731.*

Comparison of the value of several serological tests in rheumatoid disease. *Garry, M. W., and J. F. Lopez. p. 225.*

Diagnostic difficulties in hyperthyroidism. *Barrett, O., and D. J. Sheehan. p. 235.*

AMERICAN JOURNAL OF ROENTGENOLOGY. *Vol. 85, Jan. 1961.*

◇ **The Syndrome of Exophthalmos, Hypertrophic Osteoarthropathy, and Pretibial Myxedema. M. W. Elson. pp. 114-118.**

This report describes an adult Negro female who developed hypertrophic osteoarthropathy and pretibial myxedema after I^{131} therapy. Hypertrophic osteoarthropathy is characterized by clubbing of the fingers and toes, non-pitting edema of the distal portions of the extremities and subperiosteal proliferation of bone. This has rarely been observed with diseases of the thyroid. The new bone growth is confined to the portion between the cortex and periosteum, particularly in the distal ends of the forearm and leg, metacarpal and metatarsal bones. The syndrome is relatively rare but can occur after I^{131} therapy, subtotal thryroidectomy and potassium iodide medication.

◇ **Multiple Myeloma and Intravenous Pyelography. T. Leucutia. pp. 187-190.**

Theories have been advanced that Bence Jones proteins lead to laminated deposits of hyaline casts in the renal tubules with resultant mechanical obstruction and finally uremia. These casts may occur in the entire nephron up to the proximal convoluted tubule. Kidney changes are reported in more than fifty per cent of multiple myeloma patients. Renal disease, therefore, is a common guise under which myeloma may masquerade before other signs become apparent. The use of intravenous pyleography may prove disastrous in cases of "myeloma kidney." There are numerous reports of anuria following injection of contrast media. Post-mortem examinations reveal cast-plugged tubules. Some believe that precipitation of the intratubular proteins is the main factor in acute renal failure following pyelography. Precautions are stressed before routine injections, particularly in frank and occult cases of multiple myeloma.

Sensitization and recovery phenomena after embryonic irradiation. *Sikov, M. R., and J. E. Lofstrom. p. 145.*

AMERICAN JOURNAL OF ROENTGENOLOGY. *Vol. 85, No. 2, Feb. 1961.*

◇ **Compression of the Tracheobronchial Tree by the Action of the Voluntary Respiratory Musculature in Normal Individuals and in Patients with Asthma and Emphysema. E. Dekker, and R. C. Liedboer. pp. 217-229.**

For many years, asthmatic wheezing was thought to have its origin in the trachea and larger bronchi which were narrowed by voluntary action. Later, another explanation suggested that the origin of tracheobonchial narrowing during the wheezing expiration might be the passive compression of the larger airways by a high intrathoracic pressure. Initiation of asthmatic breathing demonstrates prolonged expiration following an abbreviated period of inspiration, particularly after giving a slight cough. This review was performed to study the problem as to whether the expiratory narrowing of the tracheobronchial tree during cough, asthma and emphysema is active or passive in nature. Studies emphasized the diameter of the trachea and main bronchi during voluntary wheezing in normal individuals and in patients with asthma and emphysema. During normal respiration, the tracheobronchial tree changes its diameter. This is regarded as a static change which appears to take place in the smaller and more peripheral airways. Dynamic changes, however, appear to be located in the central airways. The occurrence of strong dynamic respiratory caliber changes during cough and attacks of dyspnea with asthma seems to be well founded. Voluntary wheezing expiration likewise produces narrowing of the larger airways. The narrowing probably is the result of high intrathoracic pres-

sure which compresses the airways. It is of interest to note that air flow resistance was not a major factor in the compressed state of the larger passages.

◇ **Accessory Diaphragm; A Case Report. G. Nigogosyan, and A. Ozarda. pp. 309-312.**

An accessory diaphragm is a rare anomaly. It consists of a second leaf of diaphragm, normally located in the right chest cavity and separates the lower lobe from the remainder of the lung. Roentgenologic differential diagnosis is based upon elevation of the right diaphragm and thickening of the oblique fissure without evidence of any other lesion in the right chest. In two other cases reported bronchiectasis was discovered in the right lower lobe. This case report only demonstrates supernumerary lobes with fibrotic tissue while others described accessory muscular diaphragms.

✶

AMERICAN JOURNAL OF ROENTGENOLOGY. *Vol. 85, No. 3, March 1961.*

◇ **Lymphosarcoma: Survival and the Effects of Therapy. S. A. Rosenberg; H. D. Diamond, and L. F. Craver. pp. 521-533.**

The therapeutic agent of choice is radiation therapy. Cases with the diagnoses of lymphosarcoma from 1928 to 1958 were studied. Histological classification centered about giant follicular lymphosarcoma, lymphosarcoma and reticulum cell sarcoma. These diseases are more frequent in males with the ratio of 1.7-1.0. The greatest number of cases are seen during the fifth decade and the mean age group is 49.7 years. Over seven per cent of the total group demonstrated leukemic changes; this was more prevalent in the younger age groups. These tumors are comparatively radiosensitive and therefore, the value of radiation therapy is well established. Results from treatment: (1) Radiation Therapy—the first course resulted in objective improvement in 78.4% of cases while in 20% there was complete benefit; (2) Alkylating Agents—objective benefit was noted in 19.3% of patients after the first course of treatment and in 10.8% after the second. There was complete benefit in only two patients; (3) Anti-Metabolic Drugs—objective benefit was noted in only 29.3% with no complete response; (4) Adrenal Steroids—patients may achieve symptomatic improvement by suppression of pain, and fever as well as restoration of weight. Only 8.9% demonstrated partial benefit; (5) Radioactive Phosphorus—the use of radioactive phosphorus is now restricted to those patients showing the transition to chronic lymphatic leukemia, and (6) Combination Therapy—in some situations, intravenous administration of a rapidly acting alkylating agent immediately prior to radiation therapy is indicated. Alkylating agents seem to allow the use of larger and more frequent increments of radiation. It is concluded that radiation is the treatment of choice because the tumors are highly radiosensitive.

Skin and subcutaneous reactions induced by supervoltage irradiation. *Liegner, L. M., and N. J. Michaud. p. 533.*

✶

AMERICAN JOURNAL OF ROENTGENOLOGY. *Vol. 85, April 1961.*

◇ **Agenesis of the Sacrum and Coccyx. P. M. Dassel. pp. 697-701.**

Agenesis of the sacrum and coccyx is relatively uncommon. Classically, the lower extremities are tapered, especially below the knees, due to marked muscular deficiencies and underdevelopment. There is an attitude of external rotation and partial flexion. Club foot deformity is usually present and the resultant gait is awkward. The lower spinal nerves are involved with primary involvement of sacral nerves two to five with subsequent sensory impairment to the perineum, urinary incontinence and an atonic anal sphincter. If the fifth lumbar and the first sacral nerves are involved, the intergluteal area characteristically shortens and the buttocks become small and flattened. The first sacral segment is a necessary support for the pelvic ring. Absence produces a vertical position of the innominate bones and dislocation of the hips. Other congenital abnormalities of spine and ribs as well as soft tissue may accompany the absence of the sacrum and coccyx.

◇ **Defect of the Corpus Callosum and Congenital Occlusion of Fourth Ventricle With Tuberous Sclerosis. G. B. Elliott, and D. W. Wollin. pp. 701-706.**

Primitive cells in the differentiating fetus are particularly susceptible to permanent injury by viruses and chemicals. It is the critical timing of such an injury that determines the congenital abnormality. The authors document a case of agenesis of the corpus callosum associated with

tuberous sclerosis. Experimentally, defects and malformations correspond with the time at which a harmful agent damages embryonic processes which are actively proliferating. Multiple anomalies are more common than solitary ones because a noxious agent damages various organs forming at the same time. Agenesis of the corpus callosum regularly concurs with failure of development of the rhinencephalon. There is a characteristic roentgenographic picture of this condition due to the absence of the roof of the third ventricle or the presence of a common ventricular connection. This case report demonstrates the arrest of development of the corpus callosum and rhinencephalon before the end of the third month of fetal life. The foramina of Magendie and von Luschka begin to appear about the fifth or sixth week of embryonic life and in this case they were absent. Therefore, there is belief that the lesions dated from this time.

Familial idiopathic osteoarthropathy. *Currarino, G., R. C. Tierney; R. G. Giesel, and C. Weihl. p. 633.*

AMERICAN JOURNAL OF ROENTGENOLOGY. *Vol. 85, May 1961.*

◇ **Calcific Tendinitis of the Shoulder Joint. F. P. Milone, and M. M. Copeland. pp. 901-912.**

This article reports 136 cases of calcareous tendinitis treated by radiation therapy. The term reflects primary deposition of calcium in tendinous tissue with secondary deposition into the bursal sac. Anatomically, the importance of the rotator cuff and its relationship to the subacromial bursa was briefly stressed. Etiological factors include observations that oxidation in necrotic tissue, such as the supraspinatus tendon, is reduced by poor circulation with resultant alkaline reaction thus causing precipitation of calcium salts in the necrotic tissue. The deposition of calcium increases tension and causes pain. Relief of symptoms occurs after reduction of tension by mechanical or surgical means. Patients with marked clinical symptoms demonstrate roentgen evidence of calcification in 37.4 per cent of cases. Calcific tendinitis is characterized by pain and tenderness lateral to the acromion which is accentuated by motion. It is more common in females and occurs in the right shoulder in 60 per cent of cases. Patients were classified as acute, subacute, chronic and chronic with acute exacerbation. The most successful forms of therapy appear to be: (1) needling and aspiration by injections of procaine and hydrocortisone and (2) roentgen therapy. Roentgen therapy may be successful by virtue of its biological effects such as hyperemia. The results demonstrate that 80 per cent of patients with acute symptoms benefitted within seventy two hours. The authors believe that conservative measures should be used while the patient's shoulder is immobilized by pain. They form the opinion that roentgen therapy and/or needling and aspiration is necessary to reduce the period of morbidity and the complications such as adhesive capsulitis.

Bronchogenic carcinoma metastatic to the hand. *Trachtenberg, A. S., and B. Roswit. p. 886.*

ARCHIVES OF PATHOLOGY. *Vol. 71, May 1961.*

◇ **Cytological Study of Dystrophia Muscularis Mouse Muscles. A. Kitiiyakara. pp. 579-592.**

The histology of striated muscle has been known to vary under certain conditions. These alterations may reflect upon changes in fiber size, apparent increase in nuclear number, and appearance of small basophilic fibers with centrally located nuclei. These features are described in primary myopathies before degeneration and connective tissue replacement. Studies can be made upon available mice Strain 129. The purpose of the investigation is to make a detailed study of nucleic acid metabolism by cytochemical and autoradiographic procedures and to correlate findings with morphological observations of isolated fibers and tissue sections from muscles of dystrophic and normal mice. Both normal and dystrophic animals were kept together for 12-13 weeks and then killed. The results generally demonstrated that dystrophic mice were smaller and lighter than their normal litter mates. The lengths of the gracilis and rectus femoris muscles were only slightly diminished while their total weights were markedly decreased. Severe destruction of the contractile structures were only observed in moribund animals. Normal fiber diameter ranges from 20μ to 40μ while fiber diameter in dystrophic mice ranged from 5μ to 80μ. In longitudinal sections of normal muscles, nuclei are usually situated subsarcolemmally and oriented parallel to the fiber. However, in dystrophic mice, they are internally located and their axes irregularly oriented. DNA content of individual nuclei fails to demonstrate that muscles from either animal possess characteristics of proliferating tissue. There is only an apparent increase in nuclear number in dystrophic muscles due to differences in nuclear distribu-

tion. The migration of nuclei in the myofibrils is not explained. There is also no indication that metabolism of nucleic acid is depressed by the dystrophic process.

Experimental hypertension and atherosclerosis. *Rosenthal, R. E., and R. M. O'Neal. p. 554.*

BRAIN. *Vol. 84, Part I, 1961.*

◇ **Stress-Strain Phenomena in Human Peripheral Nerve Trunks. S. Sunderland, and K. C. Bradley. pp. 102-119.**

The authors studied 24 fresh autopsy specimens of median and ulnar nerves, 13 medial popliteal and 15 lateral popliteal nerves using an instrument which applied a steady tensile load and recorded elongation vs. load automatically to study maximum load, elongation, and location of mechanical failure. It was not possible to isolate individual elements of the nerve trunk for evaluation, but the major opposition to stretch occurred in what the authors call the "funiculus" (a dense, thick endoneural sheath composed of elastic and collagenous fibers). There were, of course, individual variations, but the authors demonstrated the elastic limit to be between 8-20 per cent, and that mechanical failure occurs at approximately 30 per cent increase over resting length. This corresponds with loads of 0.5-3.1 kg/mm^2 of nerve trunk or 1.7-6.2 kg/mm^2 of funicular area.

◇ **Stress-Strain Phenomena in Human Spinal Nerve Roots. S. Sunderland, and K. C. Bradley. pp. 120-124.**

The authors have studied 15 anterior and 17 posterior spinal nerve roots of the third sacral nerve in fresh autopsy specimens by a method similar to that above. Elastic limits for elongation for both anterior and posterior nerve roots ranged between 9-15 per cent; mechanical failure occurred in anterior nerve roots between 9-21 per cent elongation over resting length, in the posterior nerve root mechanical failure occurred at lengths 8-28 per cent over resting length. This corresponded to loads of 0.4-2.8 kg/mm^2 for anterior roots, 0.6-3.0 kg/mm^2 for posterior roots.

◇ **Stress-Strain Phenomena in Denervated Peripheral Nerve Trunks. S. Sunderland, and K. C. Bradley. pp. 125-127.**

Using the same method as above, the authors studied the distal segments of nerves of six cats three weeks after section to cause degeneration of axoplasm and myelin. They found, by comparing transected with intact nerves, that the elastic properties and tensile strengh of the cat nerve reside in the endoneurium.

Psychogenic regional pain alias hysterical pain. *Walters, A. p. 1.*

The histology of the neuromuscular junction in dystrophia myotonica. *MacDermot, V. p. 75.*

JOURNAL OF CLINICAL INVESTIGATION. *Vol. 40, Jan. 1961.*

The use of radioactive carbon dioxide to measure regional blood flow in the lungs of patients with pulmonary disease. *West, J. B., C. T. Dollery, and P. Hugh-Jones p. 1.*

Gamma globuline complexes in rheumatoid arthritis and certain other conditions. *Kunkel, H. G.; H. J. Muller-Eberhard; H. H. Fudenberg; and T. B. Tomasi. p. 117.*

JOURNAL OF CLINICAL INVESTIGATION. *Vol. 40, Feb. 1961.*

◇ **Lymphatic Flow in Human Subjects as Indicated by the Disappearance of I^{131}-Labeled Albumin from the Subcutaneous Tissue. W. Hollander; P. Reilly; and B. A. Burrows. pp. 222-233.**

The present study was undertaken to determine whether the rate of disappearance of human serum albumin labeled with radioiodine from the subcutaneous tissue, might give some estimate of lymphatic function in man. The disappearance rate of injected I^{131}-albumin from the subcutaneous tissue of a normal leg showed a relatively rapid decrease in radioactivity over the

injected area for the first 4-8 hours. Thereafter the radioactivity decreased more slowly. The half-time disappearance ($T\frac{1}{2}$) averaged 33.4 hours and ranged from 18 to 48 hours. In contrast to these values, the $T\frac{1}{2}$ on NaI^{131} from the subcutaneous tissue of the same subjects averaged 11.9 minutes and ranged from 7 to 18 minutes. The clearance of I^{131}-albumin from the subcutaneous tissue was significantly reduced in edema caused by lymphatic obstruction (the $T\frac{1}{2}$ averaged 101 hours and ranged from 65 to 140 hours) but significantly increased in edema caused by phlebothrombosis, congestive heart failure or hypoproteinemia ($T\frac{1}{2}$ around 16 hours). The rate of removal of NA^{24} CL or NaI^{131} from the tissues was considerably more rapid than that of I^{131}-albumin and was not significantly altered in lymphatic edema, although it was significantly reduced in cardiac edema, being about one-fourth as rapid as that in normal subjects. Following treatment of the heart failure, the removal of I^{131} albumin and inorganic ions changed in opposite directions and returned to or toward normal values. The marked reduction in the clearance of I^{131}-albumin from the subcutaneous tissue in lymphedema indicates that the principal route of removal of extravascular protein in man is through the lymphatic vessels. The findings suggest also that lymphatic flow is reduced in lymphedema but is increased in cardiac and other types of edema and that the rate of disappearance of labeled albumin might be employed as an index of lymphatic "function." The observations that the disappearance of Na^{24} or I^{131} from subcutaneous tissue is much more rapid than that of I^{131}-albumin, that it is comparable in lymphedematous and normal limbs, and that it is influenced by the degree of cardiac compensation, are in line with the evidence that inorganic ions are principally cleared from the interstitial fluid by direct diffusion through the blood capillaries into the blood stream.

A method for the determination of the volume of air in the lungs: measurement in chronic pulmonary emphysema. *Emmanuel, G.; W. A. Briscoe, and A. Cournand. p. 329.*

Studies of bone of patients with hyperparathyroidism by means of phosphate exchange experiments in vitro and quantitative microradiography. *Smeenk, D. p. 433.*

✶

JOURNAL OF PEDIATRICS. *Vol. 58, June 1961.*

◇ **Delayed Maturation in Development. R. S. Illingworth. pp. 761-770.**

The author discusses various causes of delay in maturation, illustrating the problems with 17 case reports. Although mental subnormality is the most common cause of generalized lag in development, it is certainly not the only cause. He cites several individuals (Einstein, John Hunter, and Winston Churchill among others) as examples of individuals who showed late maturation in school work but does not give reference to his sources of information. He presents examples of delay in motor, sphincter control, speech, hearing, visual, and psychological development, and points out reasons for delays in development. The paper is good general reference for all working with handicapped children.

✶

NEUROLOGY. *Vol. 10, Aug. 1960.*

◇ **A Cutaneous Disorder of Connective Tissue. H. M. Fullmer; H. D. Siedler; R. S. Krooth, and L. T. Kurland. pp. 717-724.**

Changes in dermal connective tissue are seen in about 60 per cent of patients with amyotrophic lateral sclerosis. These histological changes consist of: 1) elastosis; 2) an increase of mucopolysaccharide; 3) degeneration of arrectores pili muscles; 4) focal areas of regenerating connective tissue, and 5) collagen alterations. Histological changes are not uniform throughout the entire dermis, and were not seen in patients from the United States with other ailments. Some patients from Guam where amyotrophic lateral sclerosis has a high incidence demonstrated these histological alterations in the absence of clinical ALS.

◇ **A Simple Test of Coordination in the Fingers. C. M. Fisher. pp. 745-747.**

A useful bedside test of fine motor activity consists of tapping the tip of the flexed index finger against the inner palmar side of the interphalangeal joint of the thumb as rapidly as possible. Normal persons, under fifty years, can tap accurately and lightly at the rate of 3 to 5 per second with an amplitude of $\frac{1}{2}$ to $\frac{3}{4}$ inch. The test has value as a screening test for early neurologic illness. If abnormal, other tests should be carefully scrutinized. In cerebellar disturbances, the index finger overshoots, undershoots, stops short, or comes down with inordinate pressure.

In early Parkinsonism blocking or freezing of the index finger occurs or amplitude diminishes with successive taps. Pyramidal deficits produce a loss of speed, increased thumb movement and radiation of movement to other fingers or even the rest.

◇ **Pathogenesis of cerebral vasospasm in hypertensive encephalopathy. I. Effects of acute increases in intraluminal blood pressure on pial blood flow.** *Meyer, J. S.; A. G. Waltz, and F. Gotoh. p. 735.*

Value of equivocal signs in neurologic diagnosis. *Kennard, M. A. p. 753.*

Case report: Myasthenia gravis in one monozygotic twin. *Alter, M., and O. R. Talbert. p. 793.*

✶

PEDIATRICS. *Vol. 27, April 1961.*

◇ **A Valve For Respiratory Studies In Infants. R. J. Golinko, and A.M. Rudolph. pp. 645-647.**

The authors point out that pulmonary function studies in small infants in the past have of necessity been inaccurate because of the lack of practical accurate methods of study. Body plethysmography, face mask, and head chamber all involve a large "dead space", especially when compared with the volume of gas exchanged in respiration. They describe the construction and use of a simple valve connected to a glass U tube which fits into the infant's nostrils. They found no significant change in respiratory rates of fifty infants while using the valve. Infants undergoing cardiac catheterization while using the valve maintained oxygen saturations at control levels. This method should allow much more accurate determination of tidal volume, minute volume, oxygen consumption and carbon dioxide production in infants, and might well be used to study young patients with respiratory problems.

Report of subcommittee on accidental poisoning—Statement on diagnosis and treatment of lead poisoning in childhood. *p. 676.*

✶

PEDIATRICS. *Vol. 27, June 1961.*

◇ **Pediatricians' Appraisals of Patients' Intelligence. B. Korsch; K. Cobb, and B. Ashe. pp. 990-1003.**

This is a fascinating and timely study, in view of the great emphasis schools and rehabilitation centers have recently been placing on intelligence estimates. It is unfortunate that physicians are ever allowed to guess at a patient's mental ability and make it a part of the medical record without recourse to adequate testing. The authors point out that 88 pediatricians, in training or in practice up to 25 years, were able to estimate only two-thirds of the patients within 15 points. Length of time in practice did not improve accuracy, and multiple observers tended to rate individual children similarly. The errors were most often in the groups of high (gifted) or low (defective) ability, and since these two groups are most likely to need varying degrees of special attention, an error may lead to confusion and great harm to the child. This paper should be required reading for all rehabilitation personnel, especially the physicians who act as program directors or chiefs of service.

Epidemic pleurodynia (Bornholm Disease) due to coxsackie B-5 Virus. The interrelationship of pleurodynia, benign pericarditis and aseptic meningitis. *Bain, H. W.; D. M. McLean, and S. J. Walker. p. 889.*

Maturity ratings and the prediction of height of short 14-year-old boys. *Roswell, J., and C. C. Seltzer. p. 984.*

Treatment and parent counseling for the preschool child with cerebral palsy. An evaluation of a parent-participation preschool nursery program. *Bleck, E. E., and L. Headley. p. 1026.*

✶

NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 264 (Feb. 9) 1961.*

◇ **The Erthrocyte in Rheumatoid Arthritis. I. A Method for the Detection of an Abnormal Globulin Coating. A. E. Finkelstein; G. Kwok; A. P. Hall, and T. B. Bayles. pp. 270-273.**

Several studies have made it reasonable to suggest that in patients with rheumatoid arthritis the erythrocytes might be coated with a substance (possibly rheumatoid factor) that was reacting with its opposite substance in the circulating plasma. The present paper describes a method for the removal of the red-cell coating, as well as some of the characteristics of the coating and the frequency with which the coating was detected in patients with rheumatoid arthritis and other rheumatic and non-rheumatic diseases. The substance is in some way adherent to the erythrocyte in that removal by simple saline washing is impossible. It is possible to remove it with the polysaccharide dextran, and, in subsequent studies, it was possible to remove the substance with solutions of fraction II, sialic acid or dextrose. Once removed, the substance is capable of agglutinating latex particles coated with aggregated gamma globulin (latex-fixation test). Of 246 patients with rheumatoid arthritis, all but one had a positive dextran-cell latex-fixation test. In 38 patients with definite rheumatoid arthritis whose serum and euglobulin latex-fixation tests were negative, the dextran-cell latex fixation was positive. The occurrence of occasional positive results in patients with nonrheumatic diseases suggests the possible application of the technic to other diseases in which an autoimmune mechanism is suspected.

✶

NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 264 (Feb. 23) 1961.*

Severe extrapyramidal reaction to perphenazine treated with diphenhydramine. *Smith, M. J., and M. M. Miller. p. 396.*

✶

NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 264 (March 9) 1961.*

◇ **Relaxant Drugs in Cerebral Palsy: 1949-1960. E. Denhoff, and R. H. Holden. pp. 475-479.**

A twelve-year program of relaxant-drug research in cerebral palsy is reviewed. Drug effectiveness was charted as neuromotor ratings and behavior ratings, and compared with the effectiveness of the placebo. Eight drugs were studied. It was found that mephenesin had a beneficial neuromotor effect, whereas the behavior effect was less impressing. Chlorpromazine was rated solely on behavior ratings. It was the only drug studied that proved to have a statistically significant difference over the placebo. Neuromotor effectiveness was achieved secondarily after the children were relaxed and happy. Zoxazolamine had a beneficial behavior effect, but the neuromotor effect was identical to that of the placebo. Reserpine was not tolerated well. Carisoprodol was not considered effective. Emylcamate appeared to fulfill the requirements for a drug in cerebral palsy. Alpha-ethyl-beta-methylvaleramine was found to be relatively ineffective in doses that the children could tolerate. In four of eight drugs studied, the placebo effect was greater than the drug effect. Before indiscriminately accepting a new relaxant drug as beneficial in cerebral palsy, one should rigidly evaluate the neuromotor and behavioral effects against placebo responses.

The Ehlers-Danlos syndrome: a report of four cases in two generations of a negro family. *Bruno, C. S., and P. Narasimhan. p. 274.*

Demyelinating encephalomyelitis in a case of tetanus treated with antitoxin. *Williams, H. W., and F. H. Chafee. p. 489.*

✶

NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 264 (March 23) 1961.*

◇ **Treatment of Fractures and Dislocations of the Cervical Spine, Complicated by Cervical-Cord and Root Injuries: A Comparative Study of Fusion vs. Nonfusive Therapy. D. Munro. pp. 573-582.**

Evidence is presented to demonstrate by means of comparative studies of two groups of cervical-spine fracture dislocations, with or without cord or root complications, that treatment by internal fixation and operative fusion of the bones has a greater mortality, causes more undesirable symptoms and is less effective than treatment by skeletal traction without either internal fixation

or fusion. The return of stability to the cervical spine after injury below the level of the second cervical vertebra is most effectively accomplished and with less interference with the spinal mechanics by provision, so far as possible, for the repair of torn ligaments. This desideratum, which must include release of the associated paravertebral muscular spasm, reduction of dislocations to a practical but not necessarily an anatomically correct position, removal of any compression of the cord (if necessary by operative means without fusion or fixation) and immobilization until ligamentous healing is complete, is best accomplished by properly applied and used skeletal traction. The use of plaster of Paris for any purpose in the care of cervical fracture dislocations complicated by a cord injury is contraindicated. Its use in the noncomplicated case is not necessary but is probably harmless. Immediate, emergency or early operative bony fusion is contraindicated. Delayed operative bony fusion is permissible and probably mandatory when sufficient observation has demonstrated that irrecoverable, extensive paralysis of the paraspinal muscles is present to such a degree that the support of the head on the neck, or of the torso with the patient erect, has been lost. Delayed operative bony fusion, if indicated, is optional as a means of correcting post-therapeutic root pain. Under other circumstances it has nothing to offer as a means of treating cervical-spine or cord injuries. Internal fixation by wiring is not helpful. It is not as effective as skeletal traction; it is not reliable; it introduces a foreign body without the necessity for it and, if effective, impairs the motion and alters for the worse the mechanics of the cervical spine.

Tracheostomy in the management of respiratory problems. *Head, J. M. p. 587.*

NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 264 (March 30) 1961.*

Staphylococcal contamination of mattresses and blankets on a surgical ward under nonepidemic conditions. *Howe, C. W.; T. F. Silva; A. Marston, and D. D. B. Woo. p. 625.*

Status of vaccination against poliomyelitis, with particular reference to oral vaccination. *Paul, J. R. p. 651.*

NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 264 (April 6) 1961.*

◇ **Subclavian-Vein Thrombosis Associated with Fractures of the Clavicle: Report of Two Cases. Steinberg, I. pp. 686-688.**

The cases of two patients with malunion of fractured clavicles associated with thrombosis of the subclavian vein are recorded. One patient had pseudoarthrosis of the clavicle after a fracture 24 years ago. The other had a fracture of the clavicle 18 years earlier with excessive callus formation. In the first patient, thrombophlebitis of the arm developed, and despite anticoagulant therapy, pulmonary embolism and infarction ensued. The diagnosis of subclavian-vein thrombosis was confirmed six months later when claviculectomy was done for relief of the costoclavicular syndrome. In the second patient, angiocardiography demonstrated occlusion of the subclavian vein just below exuberant callus formation of the old fracture of the clavicle; in this case excessive hyperabduction owing to the patient's occupation was believed to be a contributing factor. Factors that may produce compression of the neural and vascular structures at the thoracic inlet are finally reviewed.

NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 264 (April 20) 1961.*

Occupational medicine (To be concluded). *Meigs, J. W. p. 810.*

NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 264 (April 27) 1961.*

Occupational medicine (Concluded). *Meigs, J. W. p. 861.*

✶

The Survey of Selected Literature for October 1961 was prepared by

Else A. Tophoj, M.D. *Odense, Denmark*	*for*	Acta Physiologica Scandinavica New England Journal of Medicine
Richard W. Stow, Ph.D. *Tehran, Iran*	*for*	American Journal of the Medical Sciences
Richard Herman, M.D. *Stamford, Conn.*	*for*	American Journal of Roentgenology Archives of Pathology
Harold M. Sterling, M.D. *Brighton, Mass.*	*for*	Brain Journal of Pediatrics Pediatrics
Osvaldo Miglietta, M.D. *Astoria, N. Y.*	*for*	Journal of Clinical Investigation
Walter C. Stolov, M.D. *Minneapolis*	*for*	Neurology

✶

You are invited to make application to present

A SCIENTIFIC PAPER, EXHIBIT OR FILM

AT THE

40th Annual Session

of the

American Congress of

Physical Medicine and Rehabilitation

New York City • Hotel Commodore

August 27-August 31, 1962

Please check one or any of the following categories. Upon receipt of this preliminary information form, official application blanks will be sent to you. The decision of the Program Committee for the 1962 session covering any portion of the meeting will be final.

☐ I wish to present a scientific paper; the tentative title is_____

_____

_____

☐ I wish to present a scientific exhibit; the tentative title is_____

_____

_____

☐ I wish to present a scientific film; the tentative title is_____

_____

_____

SIGNATURE_____ _____
(Please Print Your Name)

ADDRESS_____
(Please Print)

DATE_____

BERNARD M. BARUCH ESSAY AWARD—*v*

Sponsored by the

AMERICAN CONGRESS of PHYSICAL MEDICINE AND REHABILITATION

An annual award of $100 will be given as a prize for an essay on any subject relating to physical medicine and rehabilitation.

The following rules and regulations apply:

1. Any subject of interest or pertaining to the field of physical medicine and rehabilitation may be submitted.

2. Manuscripts must be in the office of the American Congress of Physical Medicine and Rehabilitation, 30 N. Michigan Ave., Chicago 2, not later than March 2, 1962.

3. *Contributions will be accepted from medical students only.*

4. The American Congress of Physical Medicine and Rehabilitation shall have the exclusive right to publish the winning essay in its official journal, the *Archives of Physical Medicine and Rehabilitation.*

5. Manuscripts must not exceed 3000 words (exclusive of headings, references, legends for cuts, tables, etc.), and the number of words should be stated on the title page. An original and one carbon copy of the manuscript must be submitted.

6. The essay must not have been published previously.

7. The winner shall receive a cash award of $100.

8. The winner shall be determined by the Awards and Prizes Committee of the American Congress of Physical Medicine and Rehabilitation.

9. All manuscripts will be returned as soon as possible after the name of the winner is announced. The winning manuscript becomes the exclusive property of the American Congress of Physical Medicine and Rehabilitation.

10. The American Congress of Physical Medicine and Rehabilitation reserves the right to make no award if, in the judgment of the Awards and Prizes Committee, no contribution is acceptable. Announcement of the winner will be made at the annual meeting.

dca

Announcing . . .

The Ninth Essay Award

sponsored by the

AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION

To stimulate interest in the field of physical medicine and rehabilitation, the American Congress of Physical Medicine and Rehabilitation will award annually, a prize for an essay on any subject relating to physical medicine and rehabilitation. The contest, while open to anyone, is primarily directed to interns, residents, graduate students in the pre-clinical sciences and graduate students in physical medicine and rehabilitation. The Awards and Prizes Committee suggests that members of the American Congress and American Academy of Physical Medicine and Rehabilitation bring this announcement to the attention of interested persons. The following rules and regulations apply to the contest:

1. Any subject of interest or pertaining to the field of physical medicine and rehabilitation may be submitted.

2. Manuscripts **must be** in the office of the American Congress of Physical Medicine and Rehabilitation, 30 N. Michigan Ave., Chicago 2, not later than March 2, 1962.

3. Contributions will be accepted from interns, residents, graduate students in the pre-clinical sciences, and graduate students in physical medicine and rehabilitation.

4. The essay must not have been published previously.

5. The American Congress of Physical Medicine and Rehabilitation shall have the exclusive right to publish the winning essay in its official journal, the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION.

6. Manuscripts must not exceed 3000 words (exclusive of headings, references, legends for cuts, tables, etc.), and the number of words should be stated on the title page. An original and one carbon copy of the manuscript must be submitted.

7. The winner shall receive a cash award of $200.

8. The winner shall be determined by the Awards and Prizes Committee of the American Congress of Physical Medicine and Rehabilitation.

9. All manuscripts will be returned as soon as possible after the name of the winner is announced.

10. The American Congress of Physical Medicine and Rehabilitation reserves the right to make no award if, in the judgment of the Awards and Prizes Committee, no contribution is acceptable. Announcement of the winner will be made at the annual meeting.

CONTENTS

Special Article: Management of Lower Extremity Amputees.
Allen S. Russek, M.D. 687

Trigger-Point Injection: Its Place in Physical Medicine.
Albert L. Cooper, M.D. 704

Electromyographic Data in Idiopathic Scoliosis. Dr. Jacques Le Febvre; Dr. Alice Triboulet-Chassevant, and Dr. M. S. Missirliu 710

Use of Celastic for Temporary Bracing in Peripheral Nerve Injuries. Israel Muss, M.D., and Nancy Lamport, O.T.R. 712

Vocational Rehabilitation of the Quadriplegic.
Robert A. Walker, M.A. 716

Survey of Selected Literature 722